IHSS Group SW-2
Original Landfill (IHSS-115)
Rocky Flats Environmental Technology Site
Construction Completion and Certification Report

Attachment A of the
Draft Closeout Report

Volume II

Prepared for:

Kaiser-Hill Company, LLC
Rocky Flats Environmental Technology Site
12101 Airport Way, Unit B
Broomfield, CO 80021

Prepared by:

Tetra Tech, Inc.
1900 South Sunset Street, Suite 1-F
Longmont, Colorado 80501

Tetra Tech Job No. 19-4886.002.00

September 2005

TETRA TECH, INC.

Tetra Tech, Inc. is an Equal Opportunity Employer

APPENDIX A

DESIGN DRAWINGS (100%, STAMPED) AND CONSTRUCTION SPECIFICATIONS

2

	QUAN.	DESCRIPTION	MATERIAL

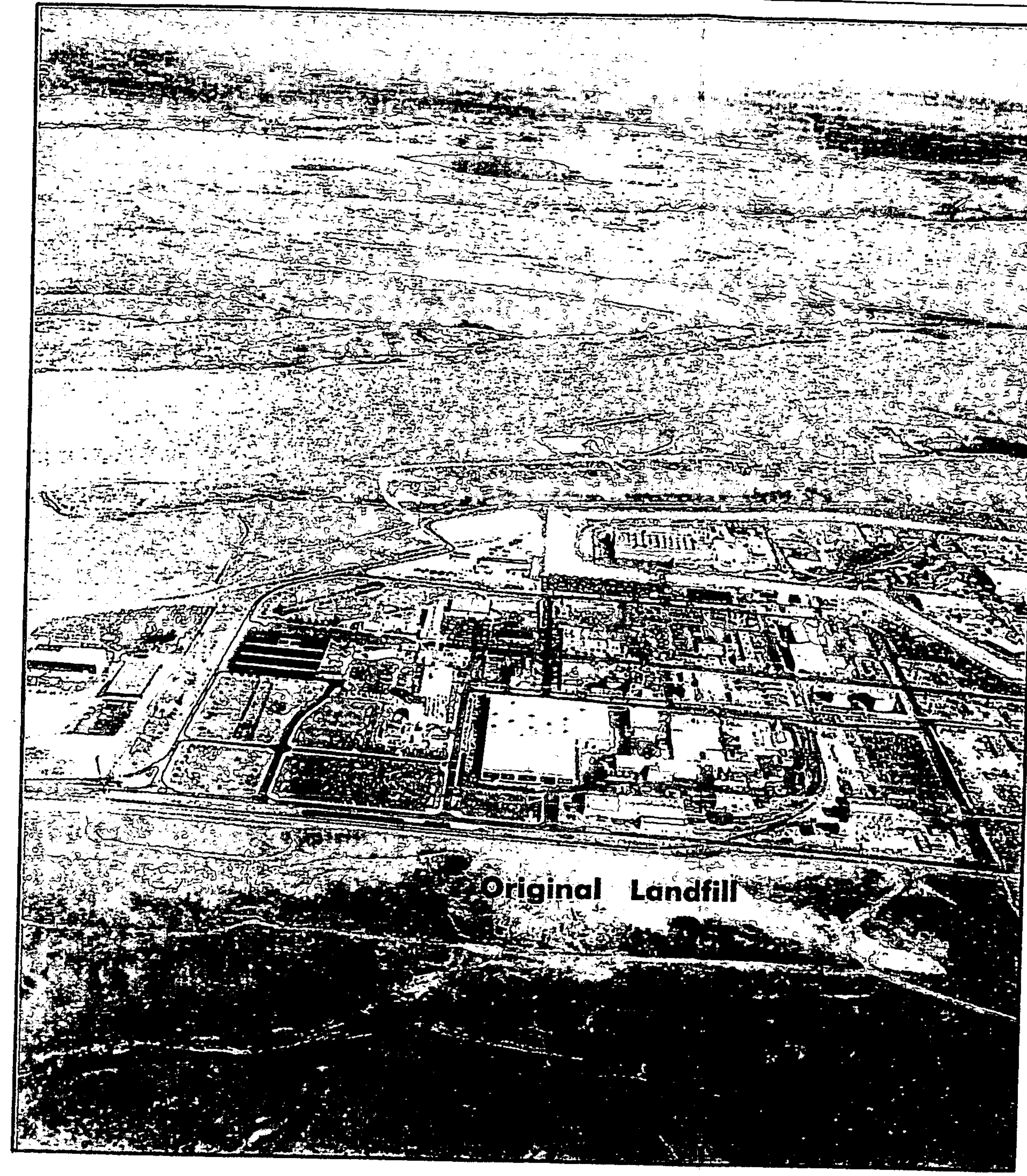
ACCELERATED ACTION DESIGN FOR THE ORIGINAL LANDFILL

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

DESIGN DRAWINGS

GOLDEN COLORADO

DRAWINGS MAY 2005



AERIAL VIEW LOOKING NORTH
December 21, 1987

FINAL COPY

COLORADO REGISTERED
RANDALL G. THOMPSON
30638
5/12/05
PROFESSIONAL ENGINEER

EARTH TECH

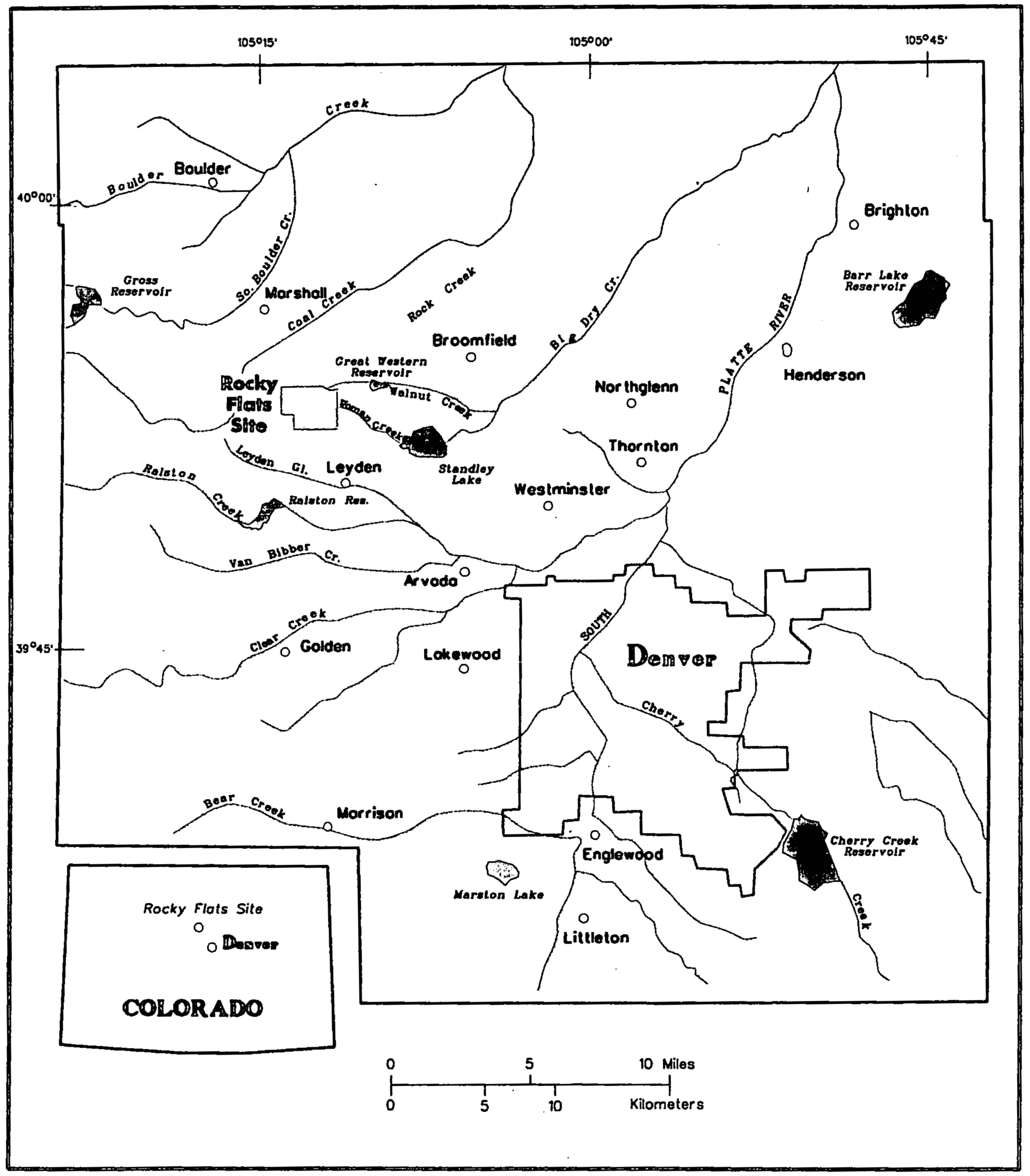
EARTH TECH, INC.
5575 DTC PARKWAY
SUITE 200
ENGLEWOOD, CO 80111
(303) 694-6660

3

QUAN.	DESCRIPTION	MATERIAL

DESIGN OF AN ENGINEERED COVER FOR THE ORIGINAL LANDFILL SHEET INDEX

VICINITY MAP



N

SHEET NO.	DESCRIPTION
51788-X001	RFETS OLF COVER SHEET
51788-001	VICINITY MAP AND DRAWING INDEX
51788-002	EXISTING CONDITIONS
51788-003	BUTTRESS FOOTING EXCAVATION
51788-004	BUTTRESS CONSTRUCTION GRADES
51788-005	CUT/FILL ISOPACH OF 1-FOOT LOWERED REGRADE SURFACE
51788-006	DESIGN TOP OF REGRADE SURFACE FINAL CONTOURS
51788-007	DESIGN TOP OF FINAL COVER CONTOURS
51788-008	DESIGN CHANNELS
51788-009	SURFACE WATER MANAGEMENT PLAN
51788-010	LANDFILL WIDE CROSS SECTIONS
51788-011	LANDFILL COVER DETAILS BUTTRESS CONSTRUCTION
51788-012 (A&B)	LANDFILL COVER DETAILS SURFACE WATER CONTROLS
51788-013	BUTTRESS CROSS SECTIONS
51788-014	FINAL COVER PERIMETER TIE IN DETAILS
51788-015A	TYPICAL WEST CHANNEL CROSS SECTIONS FOR CONSTRUCTION
51788-015B	TYPICAL EAST CHANNEL CROSS SECTIONS FOR CONSTRUCTION

DETAIL DESIGNATION

2 — DETAIL NUMBER
9 | 12 — PAGE DETAIL IS ON
PAGE CALLED OUT

DIRECTION OF VIEW

COLORADO REGISTERED PROFESSIONAL ENGINEER
RANDALL C. THOMPSON
30638
5/12/05

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ISSUE	EARTH TECH DESIGN COMPANY	DATE	DSGN	DGN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.

REVISION DESCRIPTION

0 ISSUE — ORIGINAL ISSUE — DESCRIPTION

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS
1.
2.
3.
4.
5.

TOLERANCES
FRACT. :
ANGLE :
DEC. :
UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

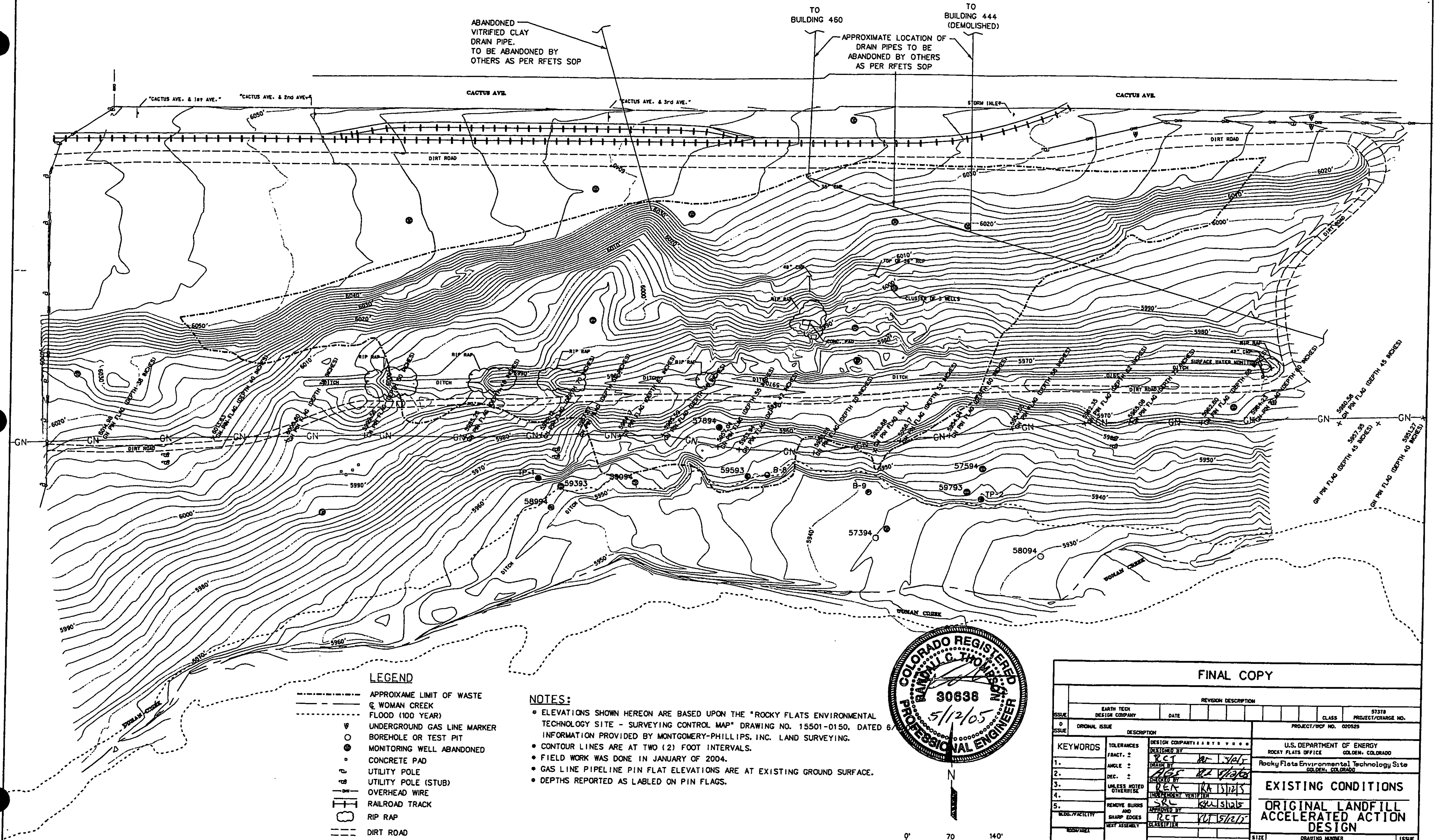
DESIGN COMPANY: EARTH TECH

DESIGNED BY: RCT	RCT	5/12/5
DRAWN BY: AGS	AGS	5/12/05
CHECKED BY: REA	RA	5/12/5
INDEPENDENT VERIFIER: SRL	SRL	5/12/5
APPROVED BY: RCT	RCT	5/12/5
CLASSIFIER		
LANDLORD		

VICINITY MAP AND DRAWING INDEX
ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-001	0

GROUP\CAD\ROCKY_FLATS\OLF_2005\LOCATION\LOCATION.DGN 3/3/05



LEGEND

- APPROIXAME LIMIT OF WASTE
- ℄ WOMAN CREEK
- FLOOD (100 YEAR)
- UNDERGROUND GAS LINE MARKER
- BOREHOLE OR TEST PIT
- MONITORING WELL ABANDONED
- CONCRETE PAD
- UTILITY POLE
- UTILITY POLE (STUB)
- OVERHEAD WIRE
- RAILROAD TRACK
- RIP RAP
- DIRT ROAD
- —GN— NATURAL GAS LINE

NOTES:

- ELEVATIONS SHOWN HEREON ARE BASED UPON THE "ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE - SURVEYING CONTROL MAP" DRAWING NO. 15501-0150, DATED 6/ INFORMATION PROVIDED BY MONTGOMERY-PHILLIPS, INC. LAND SURVEYING.
- CONTOUR LINES ARE AT TWO (2) FOOT INTERVALS.
- FIELD WORK WAS DONE IN JANUARY OF 2004.
- GAS LINE PIPELINE PIN FLAT ELEVATIONS ARE AT EXISTING GROUND SURFACE.
- DEPTHS REPORTED AS LABLED ON PIN FLAGS.

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 5/12/05

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ISSUE	EARTH TECH DESIGN COMPANY	DATE	REVISION DESCRIPTION	CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION				PROJECT/WCF NO. 020525

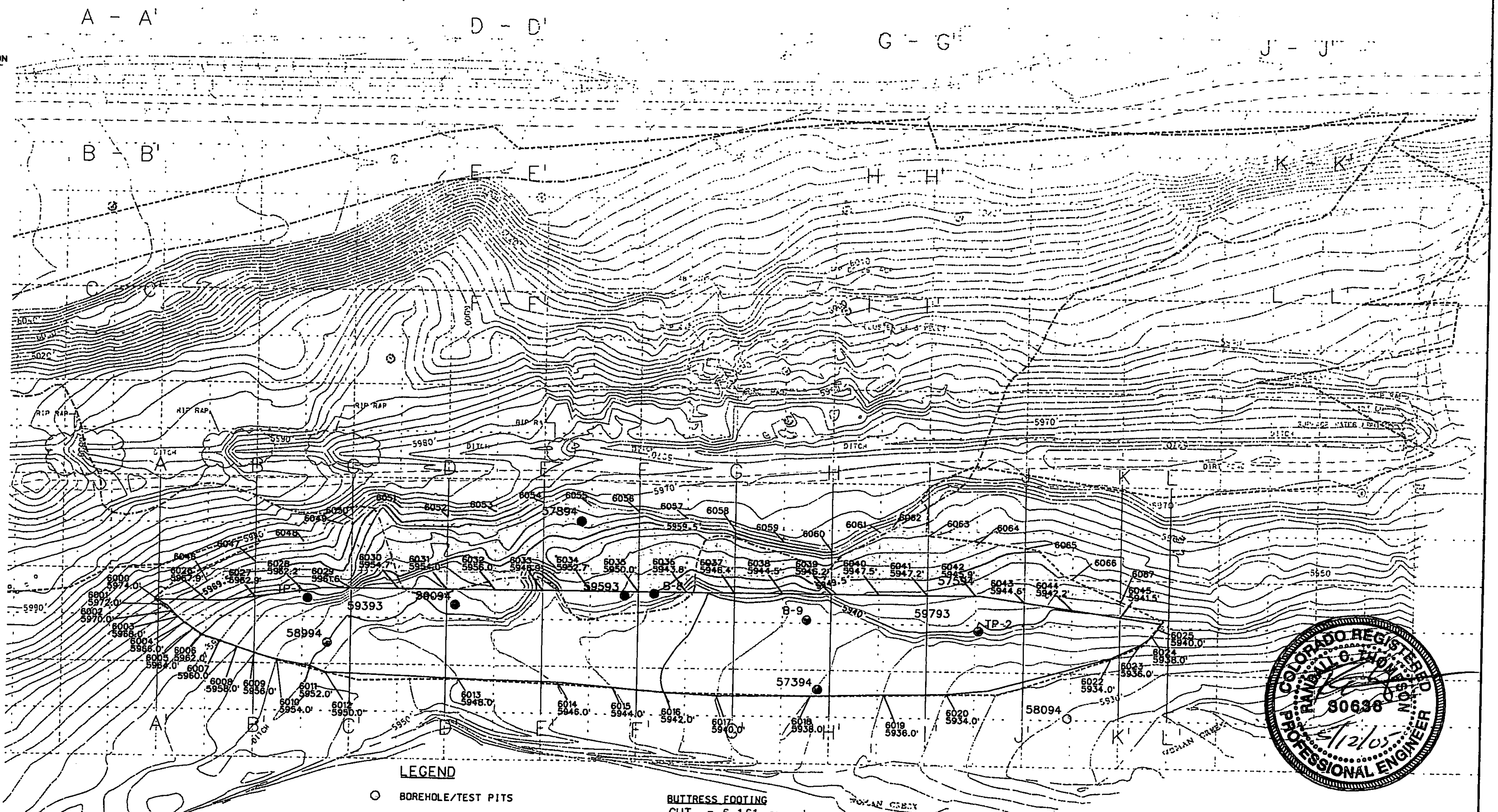
KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH	
1.	FRACT. ±	DESIGNED BY RCT 5/12/5	U.S. DEPARTMENT OF ENERGY ROCKY FLATS OFFICE GOLDEN, COLORADO
2.	ANGLE ±	DRAWN BY AGS 5/12/05	Rocky Flats Environmental Technology Site GOLDEN, COLORADO
3.	DEC. ±	CHECKED BY REN RA 5/12/5	EXISTING CONDITIONS
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER SRL 5/12/5	ORIGINAL LANDFILL ACCELERATED ACTION DESIGN
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY RCT RCT 5/12/5	
BLDG./FACILITY	NEXT ASSEMBLY	CLASSIFIER	SIZE B
ROOM/AREA			DRAWING NUMBER 51788-002
GRID COORD./COL NO.	SCALE: AS SHOWN		ISSUE 0

GROUP\CAD\ROCKY_FLATS\Olf_2005\EXISTCOND\EXISTCON.dgn Date: 3-2005

QUAN.	DESCRIPTION	MATERIAL

CONSTRUCTION CONTROL POINTS

POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
6000	747566.3	2081298.6	5974
6001	747560.2	2081308.2	5972
6002	747554	2081316	5970
6003	747548	2081320.7	5968
6004	747541.8	2081327	5966
6005	747535.7	2081335.2	5964
6006	747529.5	2081345.5	5962
6007	747523.3	2081358.8	5960
6008	747516.9	2081381.7	5958
6009	747510.5	2081400.9	5956
6010	747504.2	2081423.2	5954
6011	747497.5	2081458.6	5952
6012	747491.3	2081474.4	5950
6013	747486	2081612.8	5948
6014	747483	2081716.8	5946
6015	747478.6	2081775.4	5944
6016	747474	2081828.2	5942
6017	747471.2	2081882.4	5940
6018	747472.2	2081980.8	5938
6019	747474.5	2082056.3	5936
6020	747475.5	2082120	5934
6021	747480.5	2082164.8	5934
6022	747517.2	2082293.5	5934
6023	747531.5	2082321.8	5936
6024	747540.5	2082331.6	5938
6025	747549	2082339.7	5940
6026	747566.3	2081350	
6027	747571	2081400	
6028	747578.3	2081450	
6029	747581.3	2081500	
6030	747581.3	2081550	
6031	747581.3	2081600	
6032	747581.3	2081650	
6033	747581.3	2081700	
6034	747581.3	2081750	
6035	747581.2	2081800	
6036	747581.3	2081850	
6037	747581.3	2081900	
6038	747581.3	2081950	
6039	747581.3	2082000	
6040	747581.3	2082050	
6041	747581.3	2082100	
6042	747581.3	2082150	
6043	747574.9	2082200	
6044	747567.7	2082250	
6045	747560.5	2082300	
6046	747587.6	2081350	
6047	747608.3	2081400	
6048	747630.9	2081450	
6049	747650	2081489.7	
6050	747654.8	2081500	
6051	747668.9	2081550	
6052	747658.8	2081600	
6053	747665.2	2081650	
6054	747675.5	2081700	
6055	747671.9	2081750	
6056	747666.9	2081800	
6057	747660.5	2081850	
6058	747650	2081900	
6059	747637.3	2081950	
6060	747628.2	2082000	
6061	747648.5	2082050	
6062	747654.5	2082063	GradeBreak
6063	747645.1	2082100	
6064	747636.1	2082150	
6065	747633.1	2082200	
6066	747601.1	2082250	
6067	747575.8	2082300	



Borehole or test pit	Depth to First Granular Soils (alluvium)	Depth from Surface to Weathered Bedrock
B-8	8.0	14.5
B-9	6.0	6.5
TP-2	4.0	6.5
TP-1	0.0	12.5
58994	0.0	4.5
59094	0.0	11.5
57394	0.0	7.4
57594	silt and clay to bedrock	16.5
59393	0.5	7.5
57894	3.2	>10
59593	3.0	14.4
59793	9.3	13.3
58094	0.0	10

LEGEND

- BOREHOLE/TEST PITS
- APPROXIMATE LIMIT REGRADING ACTIVITIES
- GRAVEL ROAD
- APPROXIMATE LIMIT OF WASTE
- 10 FOOT CONTOUR
- 2 FOOT CONTOUR
- N 40000 / E 20000 GRID COORDINATE SYSTEM

BUTTRESS FOOTING

CUT = 6,161 cu.yd.
FILL = 0 cu.yd.
NET = 6.161 cu.yd.
AREA = 2.07 ACRES

BACKSLOPE / SHADED AREA WITH 6" CUT

CUT = 1,154 cu.yd.
FILL = 5.3 cu.yd.
NET = 1,149cu.yd.
AREA = 1.44 ACRES

SEE DRAWING - 011 FOR SECTION

N

0' 60 120'

NOTES:

The footprint surface shall be prepared by stripping and removing all vegetation, root matter, and other organics and deleterious materials. In addition to stripping, soft, unconsolidated fine-grained alluvial materials (such as Unified Soil Classification System CH, CL, ML materials), particularyly highly plastic clays, shall be removed to a firm/dense condition judged suitable for the buttress foundation, as determined in the field during construction by a site engineer or geologist. the final foundation surface shall be in a condition to accept installation of the geogrid per manufacturers recommendations and is anticipated to be a relatively dense granular material (such as Unified Soil classification System SC or GC, SW or SP, or GW or GP materials). The anticipated average excavation depth for foundation preparation is 2 feet. The final excavation depth and requirements are subject to adjustment in the field during construction as determined by a site engineer or geologist. All final foundation surfaces shall be approved by the site engineer or geologist prior to placement of materials for buttress and blanket drain construction.

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ISSUE	EARTH TECH DESIGN COMPANY	DATE	CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION			PROJECT/WCP NO. 020525

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
1.	FRACT. ±	DESIGNED BY: RCT	RT	5/12/5
2.	ANGLE ±	DRAWN BY: AGS		5/12/05
3.	DEC. ±	CHECKED BY: REA	RA	5/12/5
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER: SRL		5/12/5
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY: RCT		5/12/5
BLDG./FACILITY	NEXT ASSEMBLY	CLASSIFIER		
ROOM/AREA				
GRID COORD./COL NO.	SCALE: AS SHOWN			

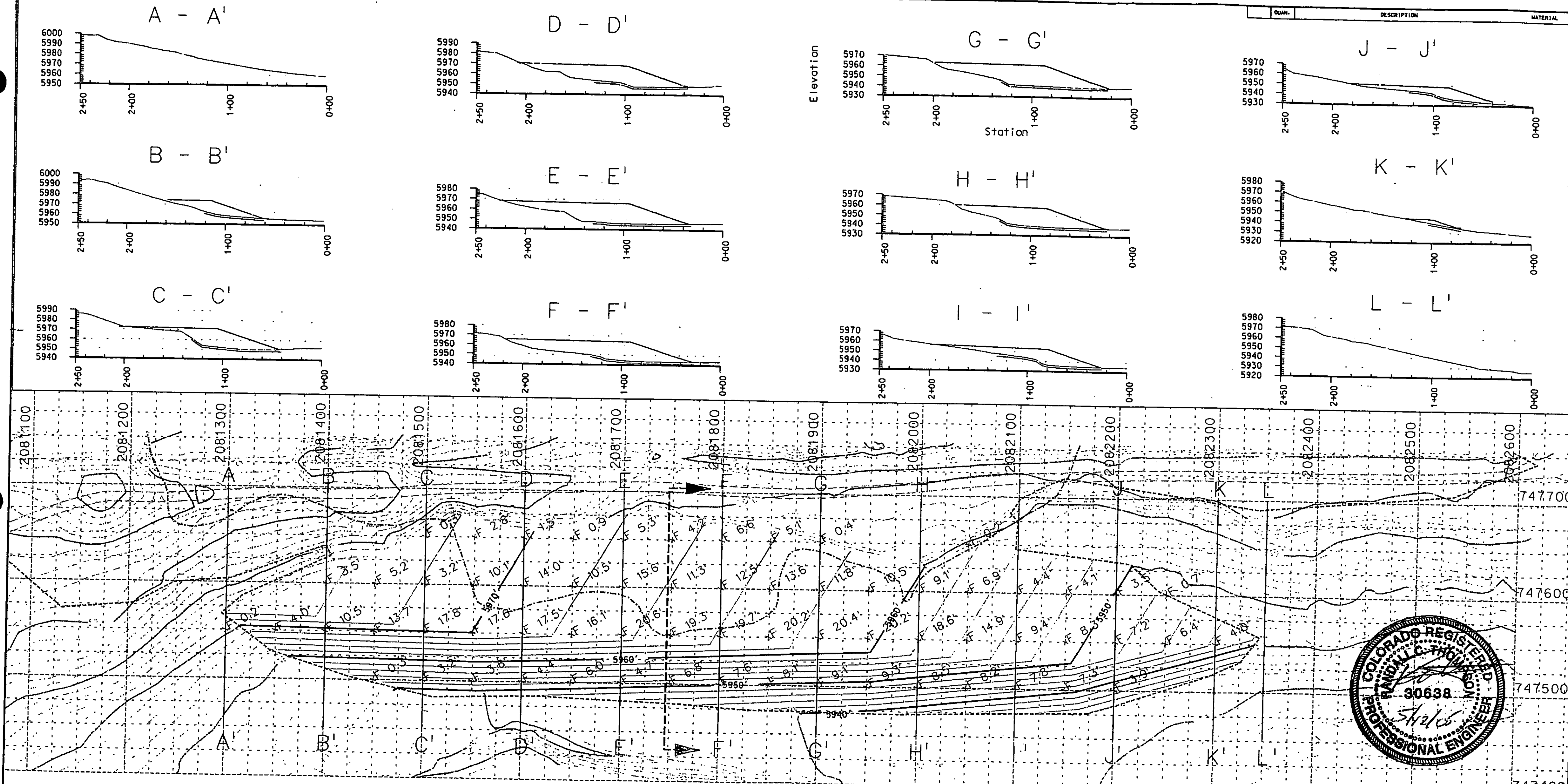
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

BUTTRESS FOOTING EXCAVATION
ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-003	0

GROUP\CAD\ROCKY_FLATS\OLF_2005\ExistCond\ExDn2ft.dgn Date: 3-2005



LEGEND

- APPROXIMATE LIMIT REGRADING ACTIVITIES
- GRAVEL ROAD
- APPROXIMATE LIMIT OF WASTE
- 10 FOOT CONTOUR
- 2 FOOT CONTOUR
- N 40000 E 20000 GRID COORDINATE SYSTEM

LINE	SURFACE
	Buttress
	Existing Surface
	Existing Surface Dropped 2ft

Scaled 1.00 Times Ver.
Scaled 1.00 Times Hor.

CUT = 137 cu. yd.
FILL = 51,997cu. yd.
NET = -51,860 cu. yd.

N

0' 50 100'

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EARTH TECH DESIGN COMPANY

ISSUE 0 ORIGINAL ISSUE

CLASS 57378 PROJECT/CHARGE NO.

PROJECT/WCF NO. 020525

KEYWORDS

DESIGNED BY RCT 5/12/5
DRAWN BY 5/12/5
CHECKED BY 5/12/5
INDEPENDENT VERIFIER SRL 5/12/5
APPROVED BY RCT 5/12/5

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

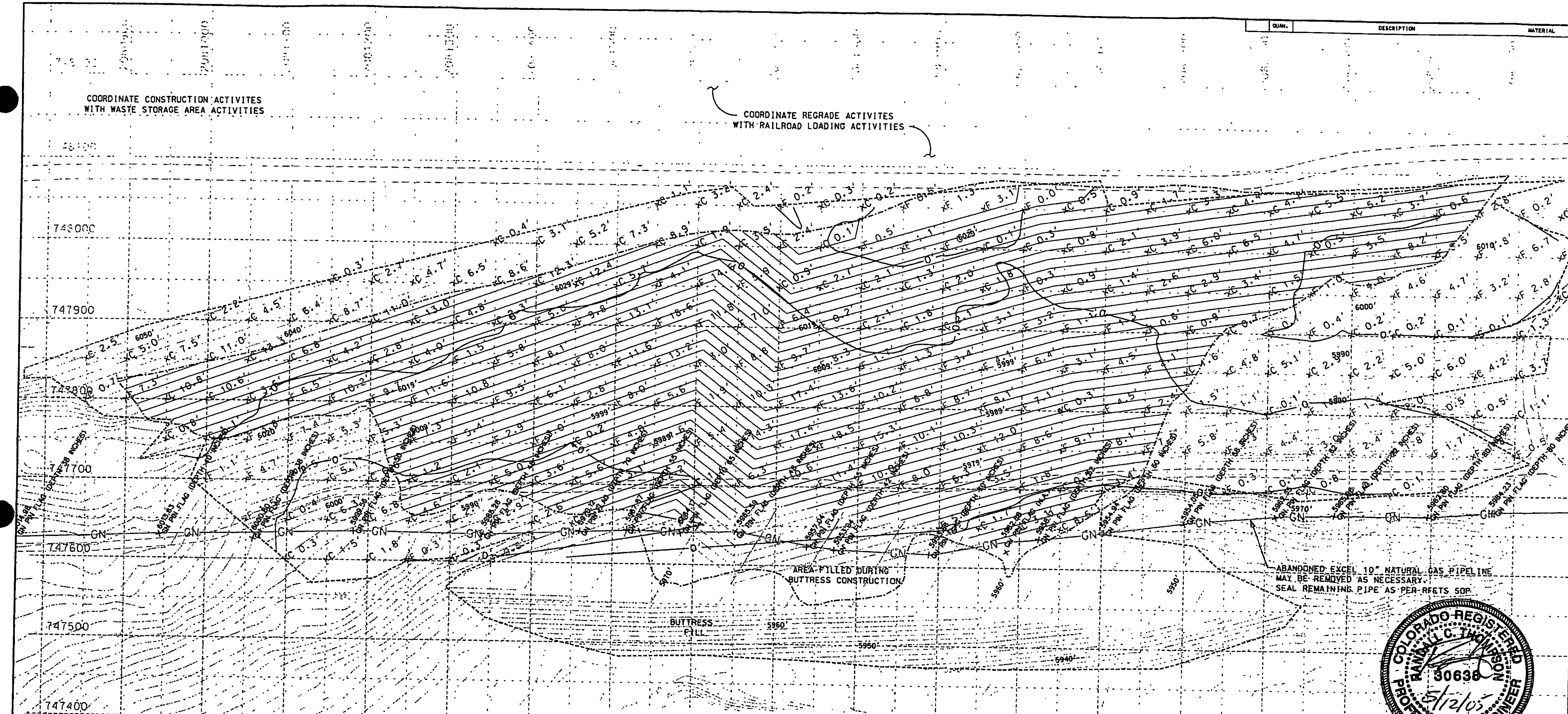
BUTTRESS CONSTRUCTION GRADES
ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SCALE: AS SHOWN

SIZE B DRAWING NUMBER 51788-004 ISSUE 0

GROUP\CAD\ROCKY_FLATS\Olf_2005\Buttress\Xsects.dgn Date: 3-2005

7



VOLUMES Based on 1 foot Drop inside Limit of Waste

CUT = 42,093 cu. yd.
FILL = 71,941 cu. yd.
NET = -29,848 cu. yd.

LIMIT OF WASTE AREA = 10.3 Acres
INSIDE 1 FOOT DROP OF REGRADES = 9.6 Acres

NOTE: CUT/FILL NUMBERS ARE APPROXIMATE. APPROXIMATELY 1-FOOT OF REGRADE WILL BE PLACED OVER THIS ENTIRE SURFACE WITHIN WASTE BOUNDARY TO REACH FINAL REGRADE FILL CONTOURS.

LEGEND

----------	APPROXIMATE LIMIT REGRADING ACTIVITIES
-·-·-·-	APPROXIMATE LIMIT OF WASTE
C 1.0'	CUT DEPTH
F 1.0'	FILL DEPTH
—— 0' ——	ZERO CUT/FILL LINE
— GN —	NATURAL GAS LINE
=======	GRAVEL ROAD
	10 FOOT CONTOUR
	2 FOOT CONTOUR
	UNDERGROUND GAS LINE MARKER
	MONITORING WELL
	CONCRETE PAD
	UTILITY POLE
	UTILITY POLE (STUB)
	OVERHEAD WIRE
	RAILROAD TRACK
	RIP RAP
N 40000 E 20000	GRID COORDINATE SYSTEM

NOTES:
- REGRADED WASTE WILL REMAIN WITHIN THE APPROXIMATE LIMITS OF WASTE.
- WASTE FOUND OUTSIDE OF THE "LIMITS OF WASTE" WILL BE EXCAVATED AND PLACED WITHIN THE "LIMITS OF WASTE" BOUNDARY.
- ELEVATIONS SHOWN HEREON ARE BASED UPON THE "ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE - SURVEYING CONTROL MAP" DRAWING NO. 15501-0150, DATED 6/6/00. INFORMATION PROVIDED BY MONTGOMERY-PHILLIPS, INC. LAND SURVEYING.
- CONTOUR LINES ARE AT TWO (2) FOOT INTERVALS.
- FIELD WORK WAS DONE IN JANUARY OF 2004.
- GAS LINE PIPELINE PIN FLAT ELEVATIONS ARE AT EXISTING GROUND SURFACE.
- DEPTHS REPORTED AS LABLED ON PIN FLAGS.

N

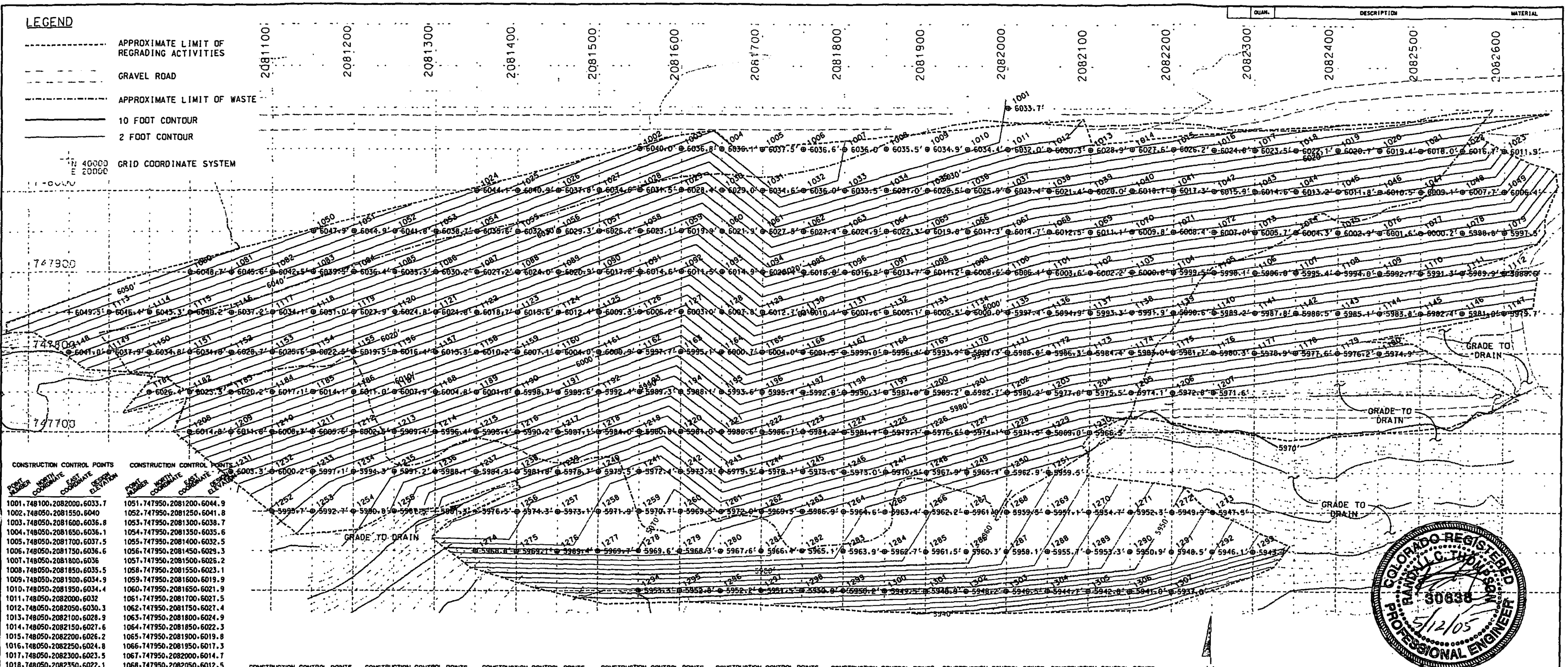
0' 60 120'

FINAL COPY

ISSUE	EARTH TECH DESIGN COMPANY	DATE	CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION			PROJECT/WCF NO. 020525

KEYWORDS	TOLERANCES FRACT. ± ANGLE ± DEC. ± UNLESS NOTED OTHERWISE	DESIGN COMPANY: EARTH TECH	U.S. DEPARTMENT OF ENERGY ROCKY FLATS OFFICE GOLDEN, COLORADO
1.		DESIGNED BY RCT 5/12/05	Rocky Flats Environmental Technology Site GOLDEN, COLORADO
2.		DRAWN BY 5/12/05	CUT/FILL ISOPACH OF 1-FOOT LOWERED REGRADE SURFACE
3.		CHECKED BY REA 5/12/05	ORIGINAL LANDFILL ACCELERATED ACTION DESIGN
4.		INDEPENDENT VERIFIER SAL 5/12/05	
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY RCT 5/12/05	
BLDG./FACILITY	NEXT ASSEMBLY	CLASSIFIER	
ROOM/AREA			SIZE B
GRID COORD./COL NO.	SCALE: AS SHOWN		DRAWING NUMBER 51788-005 ISSUE 0

GROUP\CAD\ROCKY_FLATS\Olf_2005\CutFill-6aLess1.dgn Date: 3-2005



CONSTRUCTION CONTROL POINTS

POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
1001	748100	2082000	6033.7
1002	748050	2081550	6040
1003	748050	2081600	6036.8
1004	748050	2081650	6036.1
1005	748050	2081700	6037.5
1006	748050	2081750	6036.6
1007	748050	2081800	6036
1008	748050	2081850	6035.5
1009	748050	2081900	6034.9
1010	748050	2081950	6034.4
1011	748050	2082000	6032
1012	748050	2082050	6030.3
1013	748050	2082100	6028.9
1014	748050	2082150	6027.6
1015	748050	2082200	6026.2
1016	748050	2082250	6024.8
1017	748050	2082300	6023.5
1018	748050	2082350	6022.1
1019	748050	2082400	6020.7
1020	748050	2082450	6019.4
1021	748050	2082500	6018
1022	748050	2082550	6016.7
1023	748050	2082600	6011.9
1024	748000	2081350	6044.1
1025	748000	2081400	6040.9
1026	748000	2081450	6037.8
1027	748000	2081500	6034.6
1028	748000	2081550	6031.5
1029	748000	2081600	6028.4
1030	748000	2081650	6029
1031	748000	2081700	6034.6
1032	748000	2081750	6036
1033	748000	2081800	6033.5
1034	748000	2081850	6031
1035	748000	2081900	6028.5
1036	748000	2081950	6025.9
1037	748000	2082000	6023.4
1038	748000	2082050	6021.4
1039	748000	2082100	6020
1040	748000	2082150	6018.7
1041	748000	2082200	6017.3
1042	748000	2082250	6015.9
1043	748000	2082300	6014.6
1044	748000	2082350	6013.2
1045	748000	2082400	6011.8
1046	748000	2082450	6010.5
1047	748000	2082500	6009.1
1048	748000	2082550	6007.7
1049	748000	2082600	6006.4
1050	747950	2081150	6047.9
1051	747950	2081200	6044.9
1052	747950	2081250	6041.8
1053	747950	2081300	6038.7
1054	747950	2081350	6035.6
1055	747950	2081400	6032.5
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1057	747950	2081500	6026.2
1058	747950	2081550	6023.1
1059	747950	2081600	6019.9
1060	747950	2081650	6021.9
1061	747950	2081700	6027.5
1062	747950	2081750	6027.4
1063	747950	2081800	6024.9
1064	747950	2081850	6022.3
1065	747950	2081900	6019.8
1066	747950	2081950	6017.3
1067	747950	2082000	6014.7
1068	747950	2082050	6012.5
1069	747950	2082100	6011.1
1070	747950	2082150	6009.8
1071	747950	2082200	6008.4
1072	747950	2082250	6007
1073	747950	2082300	6005.7
1074	747950	2082350	6004.3
1075	747950	2082400	6002.9
1076	747950	2082450	6001.6
1077	747950	2082500	6000.2
1078	747950	2082550	5998.8
1079	747950	2082600	5997.5
1080	747900	2081000	6048.7
1081	747900	2081050	6045.6
1082	747900	2081100	6042.5
1083	747900	2081150	6039.5
1084	747900	2081200	6036.4
1085	747900	2081250	6033.3
1086	747900	2081300	6030.2
1087	747900	2081350	6027.2
1088	747900	2081400	6024
1089	747900	2081450	6020.9
1090	747900	2081500	6017.8
1091	747900	2081550	6014.6
1092	747900	2081600	6011.5
1093	747900	2081650	6014.9
1094	747900	2081700	6020.4
1095	747900	2081750	6018.8
1096	747900	2081800	6016.2
1097	747900	2081850	6013.7
1098	747900	2081900	6011.2
1099	747900	2081950	6008.6
1100	747900	2082000	6006.1
1101	747900	2082050	6003.6
1102	747900	2082100	6002.2
1103	747900	2082150	6000.8
1104	747900	2082200	5999.5
1105	747900	2082250	5998.1
1106	747900	2082300	5996.8
1107	747900	2082350	5995.4
1108	747900	2082400	5994
1109	747900	2082450	5992.7
1110	747900	2082500	5991.3
1111	747900	2082550	5989.9
1112	747900	2082600	5988.6
1113	747850	2080900	6046.4
1114	747850	2080950	6043.3
1115	747850	2081000	6040.2
1116	747850	2081050	6037.2
1117	747850	2081100	6034.1
1118	747850	2081150	6031
1119	747850	2081200	6027.9
1120	747850	2081250	6024.8
1121	747850	2081300	6021.8
1122	747850	2081350	6018.7
1123	747850	2081400	6015.6
1124	747850	2081450	6012.4
1125	747850	2081500	6009.3
1126	747850	2081550	6006.2
1127	747850	2081600	6003
1128	747850	2081650	6007.8
1129	747850	2081700	6012.7
1130	747850	2081750	6010.1
1131	747850	2081800	6007.6
1132	747850	2081850	6005.1
1133	747850	2081900	6002.5
1134	747850	2081950	6000
1135	747850	2082000	5997.4
1136	747850	2082050	5994.9
1137	747850	2082100	5993.3
1138	747850	2082150	5991.9
1139	747850	2082200	5990.6
1140	747850	2082250	5989.2
1141	747850	2082300	5987.8
1142	747850	2082350	5986.5
1143	747850	2082400	5985.1
1144	747850	2082450	5983.8
1145	747850	2082500	5982.4
1146	747850	2082550	5981
1147	747850	2082600	5979.7
1148	747800	2080850	6041
1149	747800	2080900	6037.9
1150	747800	2080950	6034.8
1151	747800	2081000	6031.8
1152	747800	2081050	6028.7
1153	747800	2081100	6025.6
1154	747800	2081150	6022.5
1155	747800	2081200	6019.5
1156	747800	2081250	6016.4
1157	747800	2081300	6013.3
1158	747800	2081350	6010.2
1159	747800	2081400	6007.1
1160	747800	2081450	6004
1161	747800	2081500	6000.9
1162	747800	2081550	5997.7
1163	747800	2081600	5995.1
1164	747800	2081650	6000.7
1165	747800	2081700	6004
1166	747800	2081750	6001.5
1167	747800	2081800	5999
1168	747800	2081850	5996.4
1169	747800	2081900	5993.9
1170	747800	2081950	5991.3
1171	747800	2082000	5988.8
1172	747800	2082050	5986.3
1173	747800	2082100	5984.4
1174	747800	2082150	5983
1175	747800	2082200	5981.7
1176	747800	2082250	5980.3
1177	747800	2082300	5978.9
1178	747800	2082350	5977.6
1179	747800	2082400	5976.2
1180	747800	2082450	5974.9
1181	747750	2080950	6026.4
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1183	747750	2081050	6020.2
1184	747750	2081100	6017.1
1185	747750	2081150	6014.1
1186	747750	2081200	6011
1187	747750	2081250	6007.9
1188	747750	2081300	6004.8
1189	747750	2081350	6001.8
1190	747750	2081400	5998.7
1191	747750	2081450	5995.6
1192	747750	2081500	5992.4
1193	747750	2081550	5989.3
1194	747750	2081600	5988.1
1195	747750	2081650	5993.6
1196	747750	2081700	5995.4
1197	747750	2081750	5992.8
1198	747750	2081800	5990.3
1199	747750	2081850	5987.8
1200	747750	2081900	5985.2
1201	747750	2081950	5982.7
1202	747750	2082000	5980.2
1203	747750	2082050	5977.6
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1216	747700	2081400	5990.2
1217	747700	2081450	5987.1
1218	747700	2081500	5984
1219	747700	2081550	5980.8
1220	747700	2081600	5981
1221	747700	2081650	5986.6
1222	747700	2081700	5986.7
1223	747700	2081750	5984.2
1224	747700	2081800	5981.7
1225	747700	2081850	5979.1
1226	747700	2081900	5976.6
1227	747700	2081950	5974.1
1228	747700	2082000	5971.5
1229	747700	2082050	5969
1230	747700	2082100	5966.5
1231	747650	2081050	6003.3
1232	747650	2081100	6000.2
1233	747650	2081150	5997.1
1234	747650	2081200	5994.3
1235	747650	2081250	5991.2
1236	747650	2081300	5988.1
1237	747650	2081350	5984.9
1238	747650	2081400	5981.8
1239	747650	2081450	5978.7
1240	747650	2081500	5975.5
1241	747650	2081550	5972.4
1242	747650	2081600	5973.9
1243	747650	2081650	5979.5
1244	747650	2081700	5978.1
1245	747650	2081750	5975.6
1246	747650	2081800	5973
1247	747650	2081850	5970.5
1248	747650	2081900	5967.9
1249	747650	2081950	5965.4
1250	747650	2082000	5962.9
1251	747650	2082050	5959.5
1252	747600	2081100	5995.7
1253	747600	2081150	5992.7
1254	747600	2081200	5990.8
1255	747600	2081250	5987.5
1256	747600	2081400	5974.3
1257	747600	2081450	5973.1
1258	747600	2081500	5971.9
1259	747600	2081550	5970.7
1260	747600	2081600	5969.5
1261	747600	2081650	5972
1262	747600	2081700	5969.5
1263	747600	2081750	5966.9
1264	747600	2081800	5964.6
1265	747600	2081850	5963.4
1266	747600	2081900	5962.2
1267	747600	2081950	5961
1268	747600	2082000	5959.5
1269	747600	2082050	5957.1
1270	747600	2082100	5954.7
1271	747600	2082150	5952.3
1272	747600	2082200	5949.9
1273	747600	2082250	5947.5
1274	747550	2081350	5968.8
1275	747550	2081400	5969.1
1276	747550	2081450	5969.4
1277	747550	2081500	5969.7
1278	747550	2081550	5969.6
1279	747550	2081600	5968.3
1280	747550	2081650	5967.6
1281	747550	2081700	5966.4
1282	747550	2081750	5965.1
1283	747550	2081800	5963.9
1284	747550	2081850	5962.7
1285	747550	2081900	5961.5
1286	747550	2081950	5960.3
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1289	747550	2082100	5953.3
1290	747550	2082150	5950.9
1291	747550	2082200	5948.5
1292	747550	2082250	5946.1
1293	747550	2082300	5943.7
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1295	747500	2081600	5952.8
1296	747500	2081650	5952.2
1297	747500	2081700	5951.5
1298	747500	2081750	5950.9
1299	747500	2081800	5950.2
1300	747500	2081850	5949.5
1301	747500	2081900	5948.9
1302	747500	2081950	5948.2
1303	747500	2082000	5946.5
1304	747500	2082050	5944.7
1305	747500	2082100	5942.8
1306	747500	2082150	5941
1307	747500	2082200	5937

0' 60 120'

N

VOLUME OF ADDITIONAL 1-FOOT GRADE FILL WITHIN LIMIT OF WASTE

CUT = 0 cu. yd.
FILL = 15,191 cu. yd.
NET =-15,191 cu. yd.

FINAL COPY

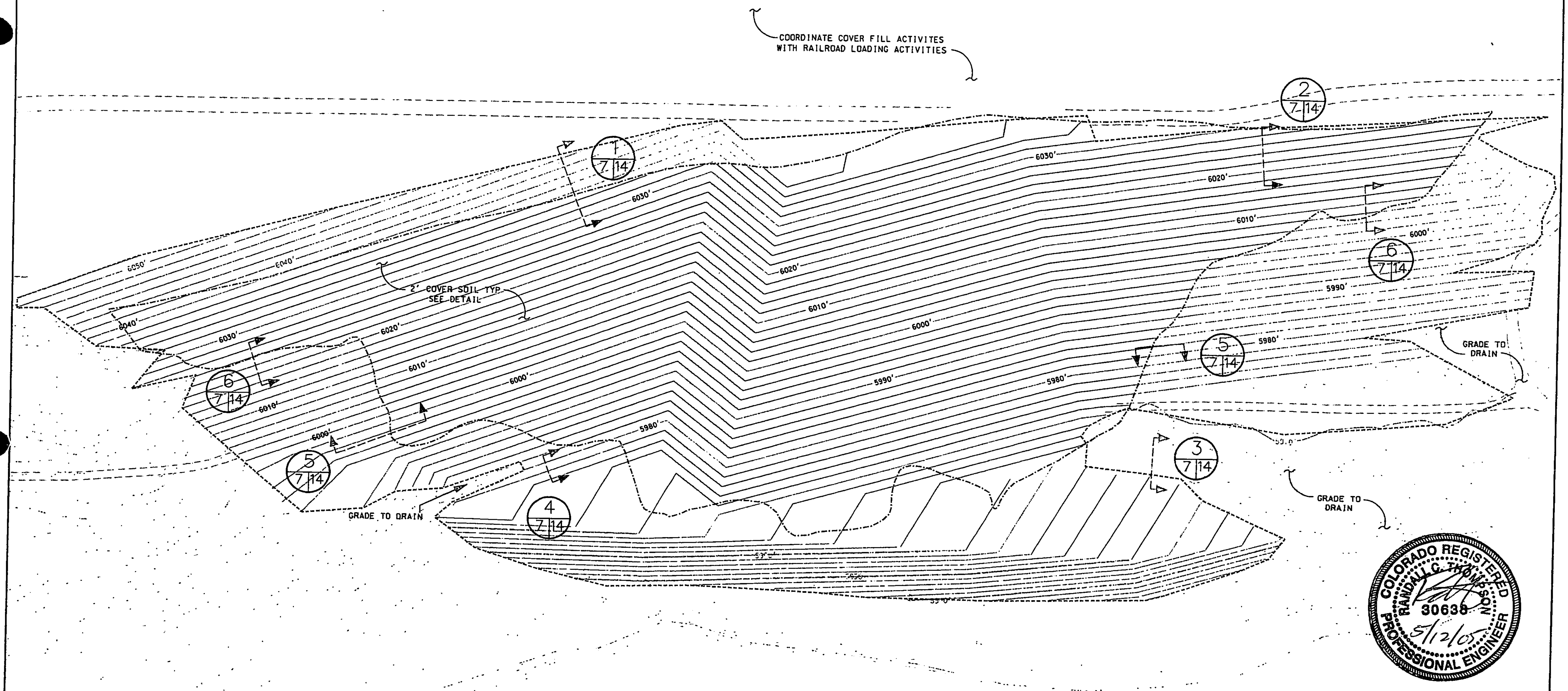
ISSUE	EARTH TECH DESIGN COMPANY	DATE	CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION			PROJECT/WCF NO. 020525

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH	
1.	FRACT. ±	DESIGNED BY RCT RT 5/12/5	U.S. DEPARTMENT OF ENERGY ROCKY FLATS OFFICE GOLDEN, COLORADO
2.	ANGLE ±	DRAWN BY BGS BL 5/12/05	Rocky Flats Environmental Technology Site GOLDEN, COLORADO
3.	DEC. ± UNLESS NOTED OTHERWISE	CHECKED BY RCR RA 5/12/5	DESIGN TOP OF REGRADE SURFACE FINAL CONTOURS
4.		INDEPENDENT VERIFIER SRL SRL 5/12/5	ORIGINAL LANDFILL ACCELERATED ACTION DESIGN
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY RCT RT 5/12/5	
BLDG./FACILITY	NEXT ASSEMBLY	CLASSIFIER	SIZE B — DRAWING NUMBER 51788-006 — ISSUE 0
GRID COORD./COL NO.	SCALE: AS SHOWN		

GROUP\CAD\ROCKY_FLATS\Olf_2005\Regrades\RgPts.dgn Date: 3-2005

9

QUAN.	DESCRIPTION	MATERIAL



LEGEND

- LIMIT OF FINAL COVER
- APPROXIMATE LIMIT OF WASTE
- 10 FOOT CONTOUR
- 2 FOOT CONTOUR
- N 40000 E 20000 GRID COORDINATE SYSTEM
- GRAVEL ROAD

VOLUME OF 2-FOOT COVER

CUT = 0 cu. yd.
FILL = 38, 397cu. yd.
NET = -38, 397cu. yd.

N

0' 60 120'

FINAL COPY

ISSUE	EARTH TECH DESIGN COMPANY	DATE	CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION			PROJECT/WCF NO. 020525

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH	
1.	FRACT. ±	DESIGNED BY RCT	5/12/5
2.	ANGLE ±	DRAWN BY AGS	5/12/05
3.	DEC. ±	CHECKED BY REA	5/12/5
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER SRL	5/12/05
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY RCT	5/12/5
BLDG./FACILITY	NEXT ASSEMBLY	CLASSIFIER	
ROOM/AREA			
GRID COORD./COL NO.	SCALE: AS SHOWN		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

DESIGN TOP OF
FINAL COVER CONTOURS

ORIGINAL LANDFILL
ACCELERATED ACTION
DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-007	0

GROUP\CAD\ROCKY_FLATS\Olf_2005\FinalGrds\Finalgrd.dgn Date: 3-2005

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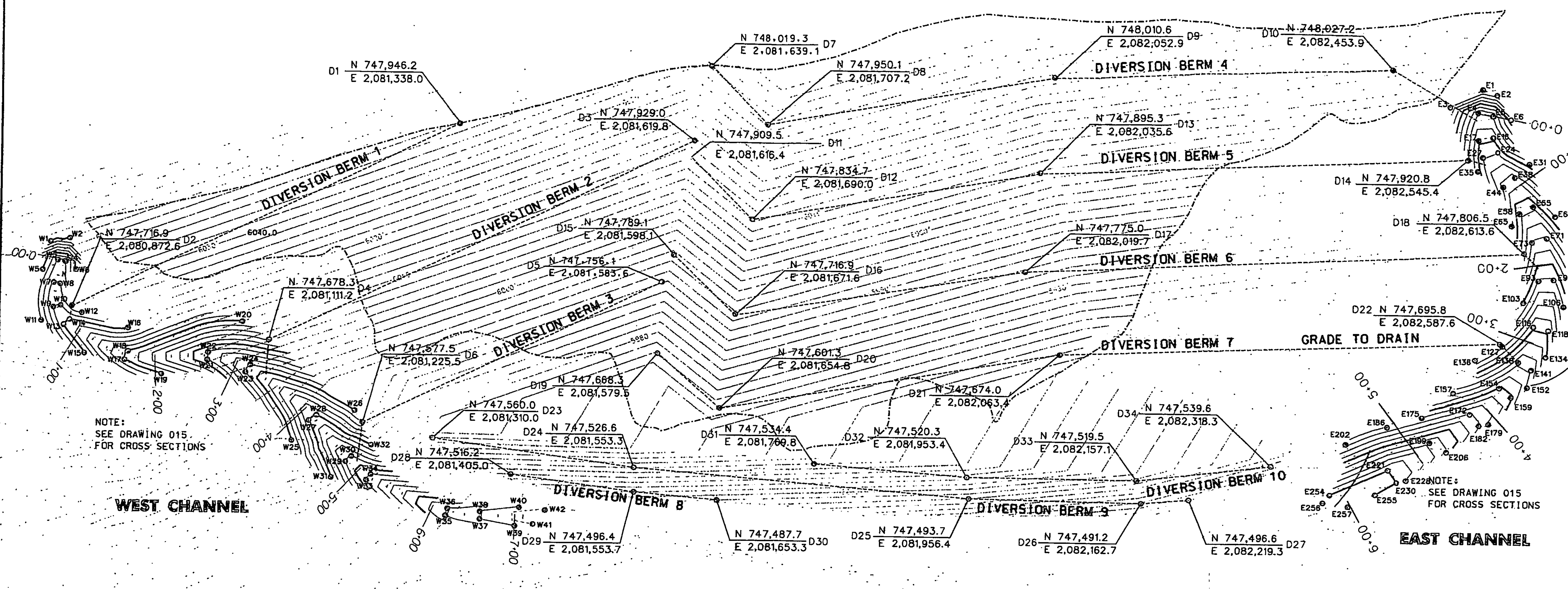


CONSTRUCTION CONTROL POINTS WEST CHANNEL

POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
W1	747796.3	2080845.4	6040.0
W2	747800.9	2080868.5	6040.0
W3	747774.9	2080854.6	6026.0
W4	747773.0	2080864.4	6026.0
W5	747763.4	2080837.0	6030.0
W6	747763.8	2080876.3	6030.0
W7	747746.8	2080849.2	6024.0
W8	747745.0	2080859.0	6024.0
W9	747716.2	2080850.2	6022.0
W10	747719.2	2080859.7	6022.0
W11	747699.8	2080835.7	6028.0
W12	747709.0	2080883.0	6024.0
W13	747694.6	2080863.1	6020.0
W14	747701.5	2080870.4	6020.0
W15	747660.2	2080889.2	6020.0
W16	747690.0	2080939.9	6020.0
W17	747652.7	2080937.7	6010.0
W18	747662.4	2080940.0	6010.0
W19	747634.7	2080982.9	6010.0
W20	747700.6	2081080.3	6010.0
W21	747652.2	2081038.4	5998.0

CONSTRUCTION CONTROL POINTS WEST CHANNEL

POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
W22	747662.2	2081038.8	5998.0
W23	747638.5	2081083.4	5992.0
W24	747647.1	2081088.4	5992.0
W25	747555.6	2081141.0	5990.0
W26	747592.2	2081215.8	5990.0
W27	747580.2	2081161.9	5980.0
W28	747586.7	2081169.5	5980.0
W29	747529.6	2081205.5	5972.0
W30	747536.5	2081212.8	5972.0
W31	747509.6	2081189.7	5980.0
W32	747549.7	2081237.0	5980.0
W33	747506.4	2081230.7	5968.0
W34	747514.6	2081236.4	5968.0
W35	747463.4	2081326.9	5956.0
W36	747473.1	2081329.4	5956.0
W37	747459.8	2081367.8	5954.0
W38	747469.8	2081368.0	5954.0
W39	747452.3	2081410.3	5954.0
W40	747475.7	2081415.9	5954.0
W41	747454.8	2081431.8	5952.0
W42	747472.9	2081446.2	5952.0

CONSTRUCTION CONTROL POINTS EAST CHANNEL

POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
E1	748005.4	2082561	6008.4
E2	747998.9	2082578.1	6006.8
E3	747983.6	2082521.7	6005.6
E4	747977.2	2082555.7	5994.1
E5	747973.9	2082573.4	5994.1
E6	747970	2082594.4	6001.2
E16	747947.7	2082574	5990.5
E17	747943.9	2082556.4	5990.5
E24	747929.8	2082578.9	5988.1
E27	747923.2	2082562.2	5988.1
E31	747915.9	2082617.8	5991.1
E35	747907	2082556.2	5991
E38	747900.2	2082600.3	5983.3
E44	747888.1	2082586.9	5983.3
E55	747864.6	2082622.7	5978.5
E58	747856.3	2082606.8	5978.5
E61	747853.2	2082648.5	5982.1
E65	747840.9	2082597.8	5982.3
E71	747826.4	2082639.1	5973.7
E73	747821	2082622	5973.7
E92	747775.2	2082648.6	5967.7
E93	747774.2	2082630.6	5967.7
E103	747747.2	2082613	5969.8
E106	747742.8	2082659.9	5988
E116	747717.4	2082625.4	5960.5

CONSTRUCTION CONTROL POINTS EAST CHANNEL

POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
E127	747692.6	2082589.1	5964.[illegible]
E134	747680.2	2082640.6	5959.[illegible]
E136	747675.4	2082557.4	5965.[illegible]
E138	747672.9	2082608.3	5954.[illegible]
E141	747664.4	2082624.2	5954.[illegible]
E152	747642.3	2082619.6	5954.6
E154	747641.3	2082587	5949.7
E157	747634.1	2082531.9	5954.5
E159	747629.8	2082600.9	5949.7
E172	747608.4	2082552	5943.7
E175	747603	2082494.5	5947.8
E179	747596.3	2082574.3	5946.6
E182	747594.3	2082563.2	5943.7
E186	747590.3	2082441.8	5948.7
E199	747572.6	2082504.4	5936.5
E202	747568.8	2082405.9	5946.7
E206	747561.2	2082525	5938.8
E221	747537.5	2082456.1	5930
E228	747525.3	2082477	5931.8
E230	747522.5	2082466.2	5930
E254	747505.2	2082387.9	
E255	747506.7	2082441.7	
E256	747495.4	2082380.1	
E257	747491.4	2082410.1	

COLORADO REGISTERED
RANDALL C. THOMPSON
30638
5/12/05
PROFESSIONAL ENGINEER

CHANNEL ALIGNMENT (TO BE DETERMINED)

CHANNEL #1
CURVE #
START:
TC -
PI -
CT -
R -

LEGEND

- DIVERSION BERM
- CONTROL POINT
- LIMIT OF WASTE
- 6+00 STATION NUMBER

N

0' 60 120'

FINAL COPY

ISSUE	EARTH TECH DESIGN COMPANY	DATE	REVISION DESCRIPTION	CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE DESCRIPTION				PROJECT/WCF NO. 020525

KEYWORDS
1.
2.
3.
4.
5.
BLDG./FACILITY
ROOM/AREA
GRID COORD./COL NO.

TOLERANCES
FRACT. ±
ANGLE ±
DEC. ±
UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY
SCALE: AS SHOWN

DESIGN COMPANY: EARTH TECH
DESIGNED BY RLA RA 5/12/5
DRAWN BY MGS [illegible] 5/12/05
CHECKED BY RCT [illegible] 5/12/5
INDEPENDENT VERIFIER SRL [illegible] 5/12/5
APPROVED BY RCT [illegible] 5/12/5
CLASSIFIER

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

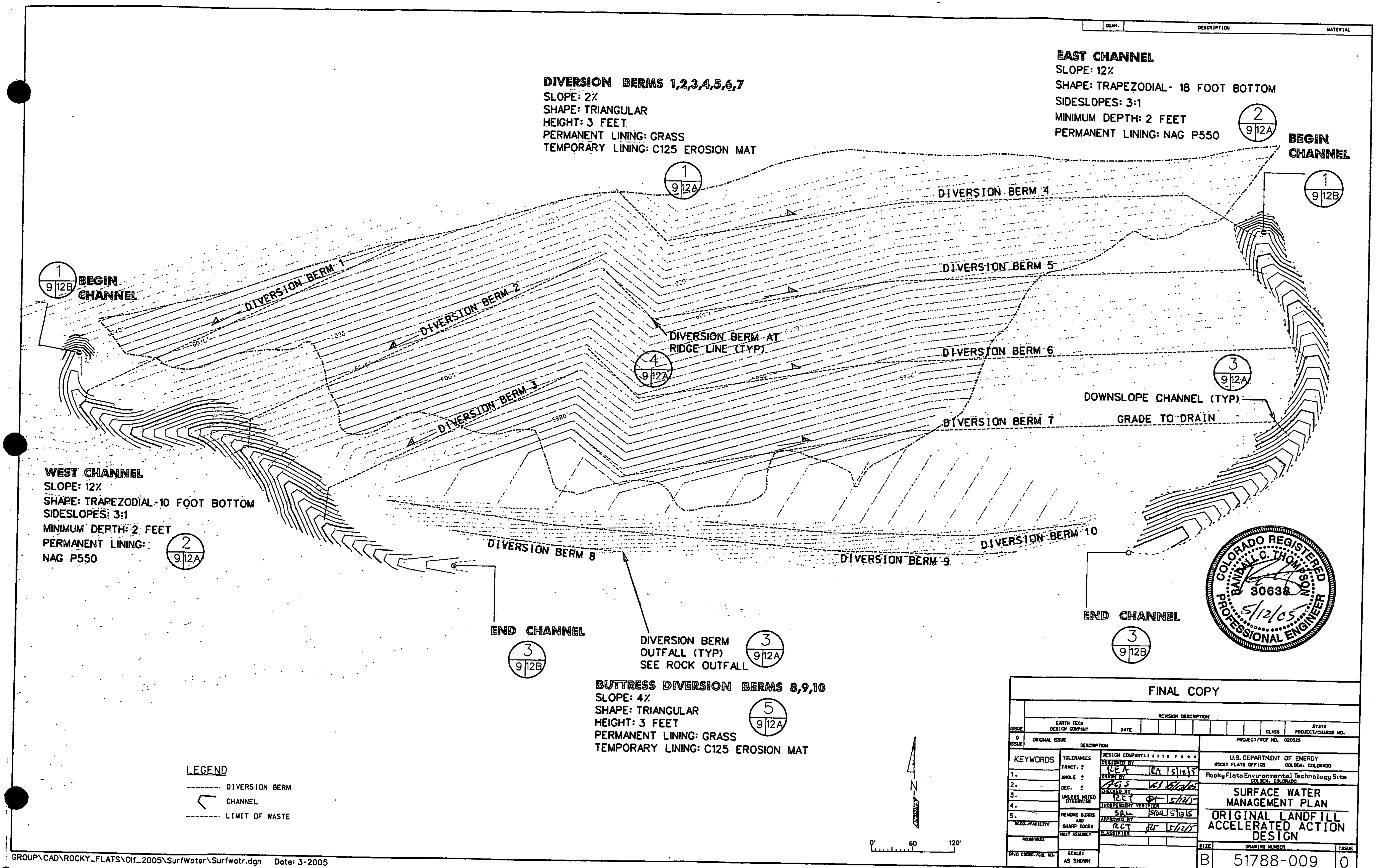
Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

DESIGN CHANNELS

ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-008	0

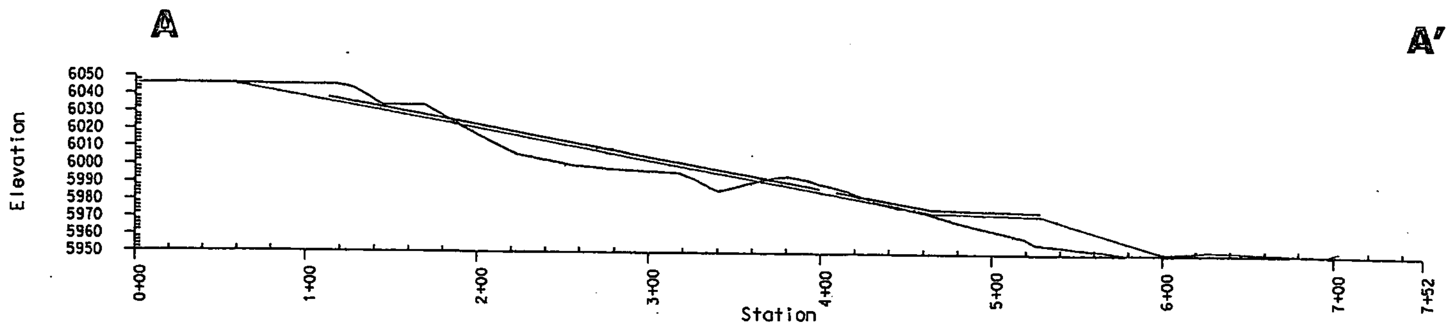
GROUP\CAD\ROCKY_FLATS\Olf_2005\SurfWater\Surf010.dgn Date: 3-2005

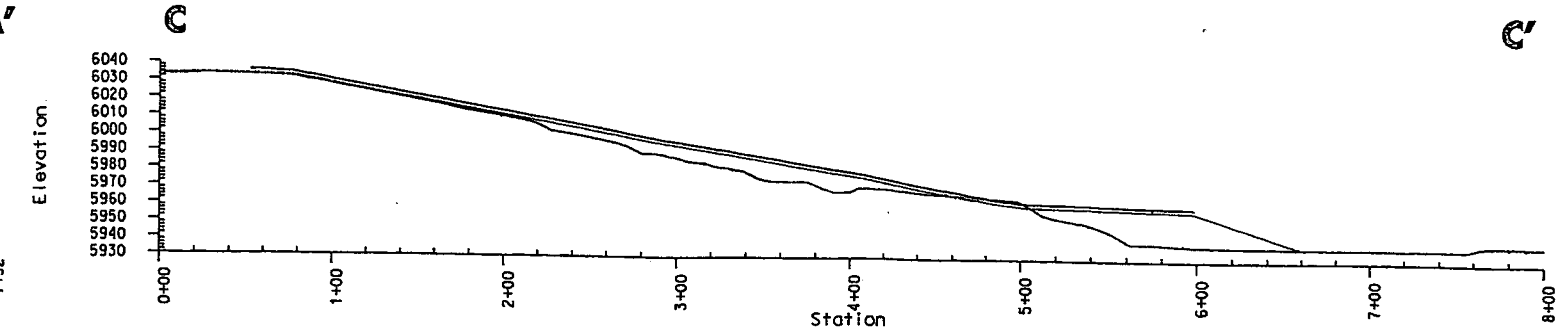


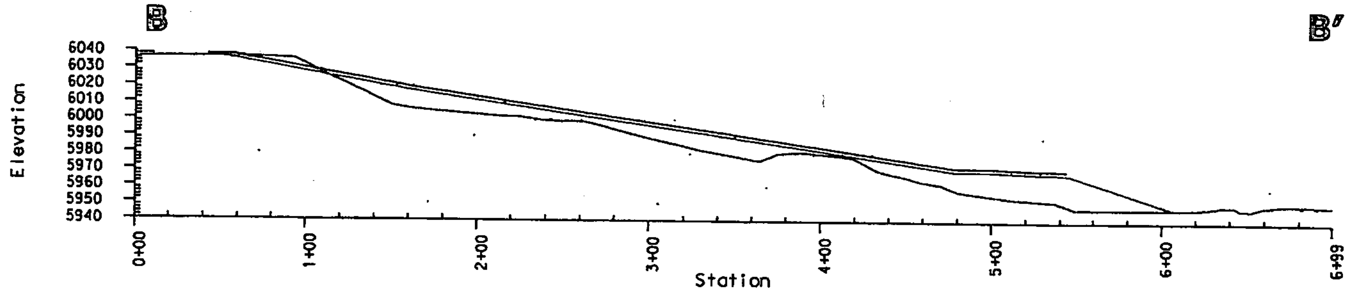
GROUP\CAD\ROCKY_FLATS\OIf_2005\SurfWater\Surfwatr.dgn Date: 3-2005

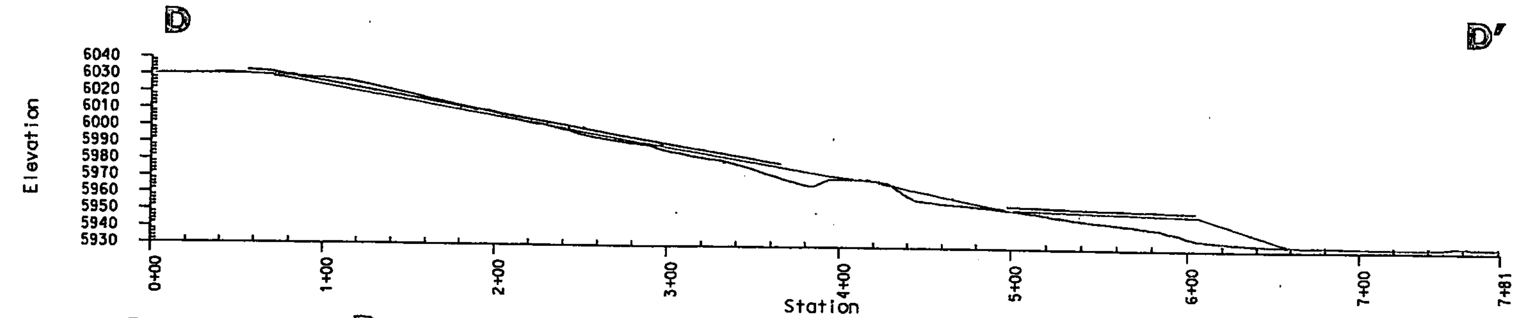
12

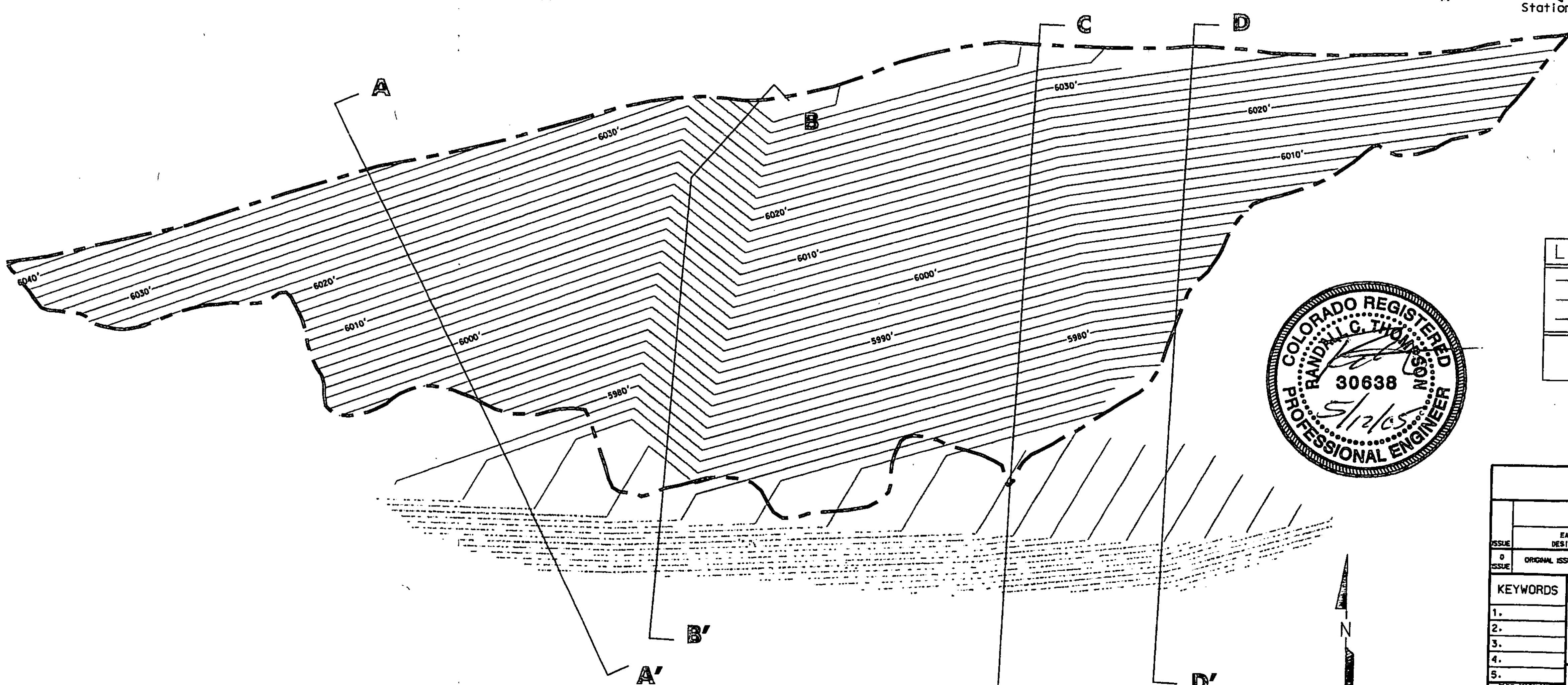
QUAN.	DESCRIPTION	MATERIAL











LINE	SURFACE	OFFSET
	Final Grades	
	Regrades	
	Existing Surface	

Scaled 1.00 Times Ver.
Scaled 1.00 Times Hor.

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 5/12/05

FINAL COPY

ISSUE	EARTH TECH DESIGN COMPANY	DATE	CLASS	57378 PROJECT/CHARGE NO.
0	ORIGINAL ISSUE			

DESCRIPTION

PROJECT/WCF NO. 020525

KEYWORDS
1.
2.
3.
4.
5.
BLDG./FACILITY
ROOM/AREA
GRID COORD./COL NO.

TOLERANCES
FRACT. ±
ANGLE ±
DEC. ±
UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY
SCALE: AS SHOWN

DESIGN COMPANY: EARTH TECH

DESIGNED BY	RET	RT	5/12/5
DRAWN BY	AG S		5/12/05
CHECKED BY	KEA	KA	5/12/5
INDEPENDENT VERIFIER	SGL	SG	5/12/5
APPROVED BY	RET	RT	5/12/5
CLASSIFIER			

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

LANDFILL WIDE CROSS SECTIONS

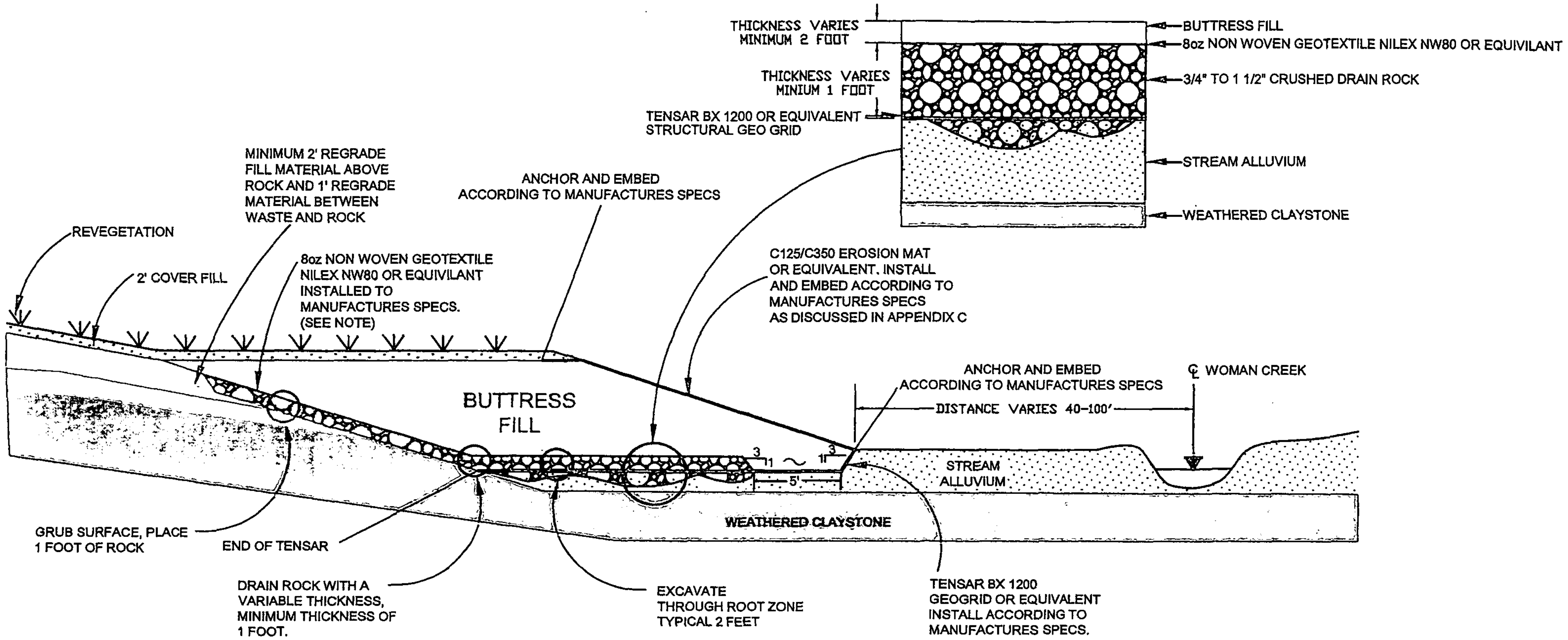
ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-010	0

GROUP\CAD\ROCKY_FLATS\Olf_2005\Xsects\XsecFG.dgn Date: 3-2005

13

QUAN.	DESCRIPTION	MATERIAL

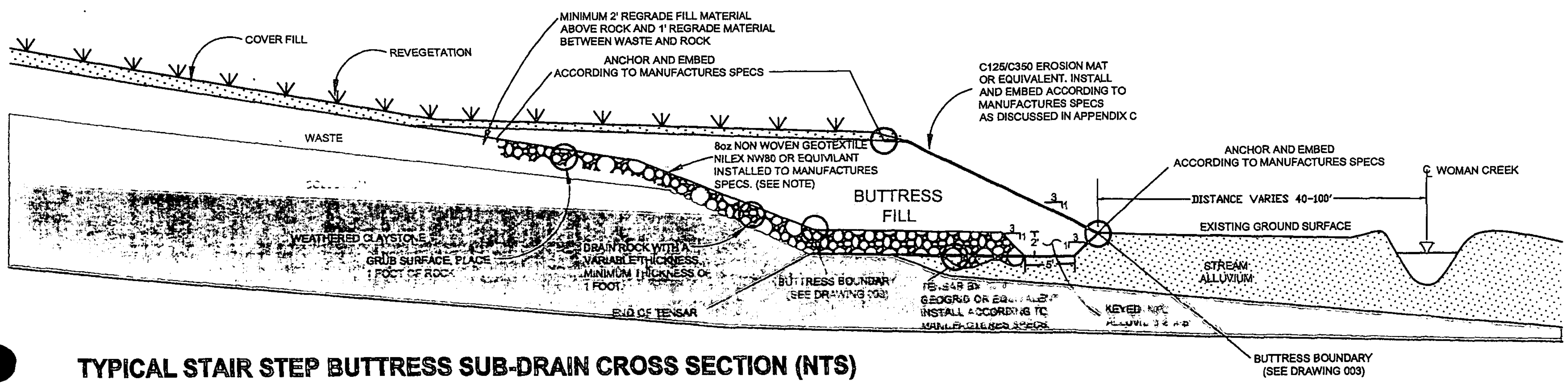


TYPICAL SLOPED BUTTRESS SUB-DRAIN CROSS SECTION B (NTS)

KEY	MATERIAL DESIGNATION	DESCRIPTION
	1a	WASTE
	2	COLLUVIUM / SLIDE
	3	ROCKY FLATS ALLUVIUM
	4	STREAM ALLUVIUM
	5	WEATHERED CLAYSTONE
	6	UNWEATHERED CLAYSTONE
	7	ENGINEERED FILL

NOTE:
GEOTEXTILE SHALL BE INSTALLED IN A 6 INCH BY 6 INCH ANCHOR TRENCH AT TOP SLOPE AND EXTENEDED 5 FEET PAST DRAIN ROCK ON SIDES AND BOTTOM.

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 5/12/05



TYPICAL STAIR STEP BUTTRESS SUB-DRAIN CROSS SECTION (NTS)

FINAL COPY

REVISION DESCRIPTION

ISSUE	DESIGN COMPANY	DATE	DSGN	DSB	CHKD	IV	APVD	CLASS	57378 PROJECT/CHARGE NO.
0	ORIGINAL ISSUE								

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS
1.
2.
3.
4.
5.

BLDG/FACILITY SITE
ROOM/AREA NA
GRID COORD/COL NO. NA

TOLERANCES FRACT. ANGLE DEC. UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY NA
SCALE AS SHOWN

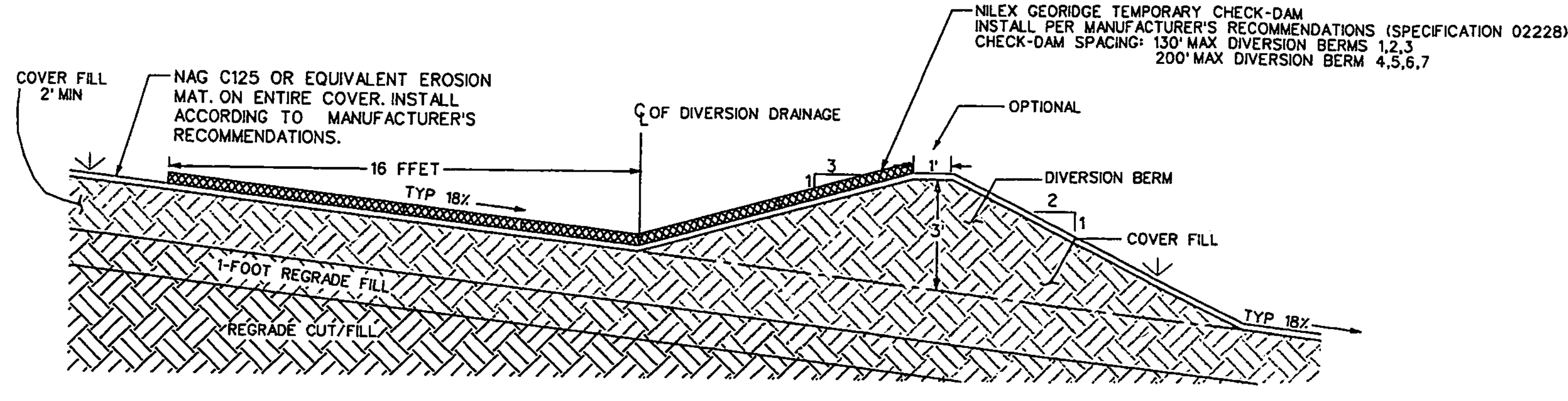
DESIGN COMPANY
DESIGNED BY CAB 5/12/05
DRAWN BY BGS 5/12/05
CHECKED BY RCT 5/12/5
INDEPENDENT VERIFIER SRL 5/12/5
APPROVED BY RCT 5/12/5
CLASSIFIER
LANDLORD

LANDFILL COVER DETAILS BUTTRESS CONSTRUCTION

ORIGINAL LANDFILL ACCELERATED ACTION

SIZE	DRAWING NUMBER	ISSUE
B	51788-011	0

L:\group\cad\rocky_flats\olf_2005\details\detail2.dgn 2/17/05

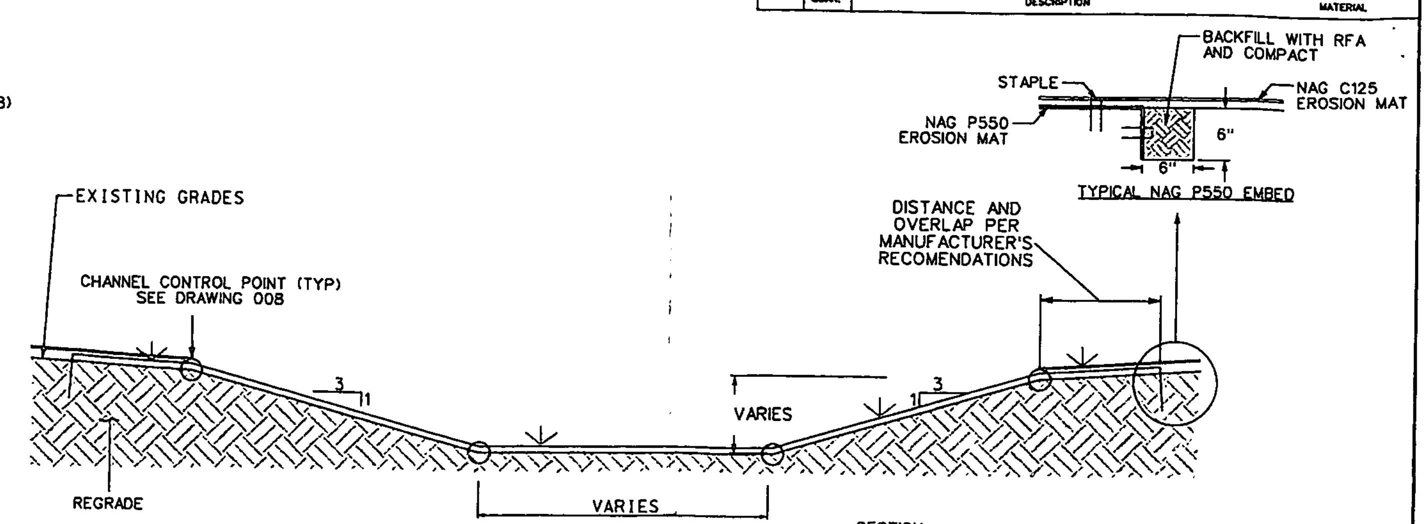


SECTION

NOTE: IN AREAS OUTSIDE OF THE WASTE "FOOTPRINT" COVER SOIL MAY BE LESS THAN 2' (IN TRANSITION AREAS) OR NO COVER SOIL

DIVERSION BERM (SECTION) 1 9 12A

NTS

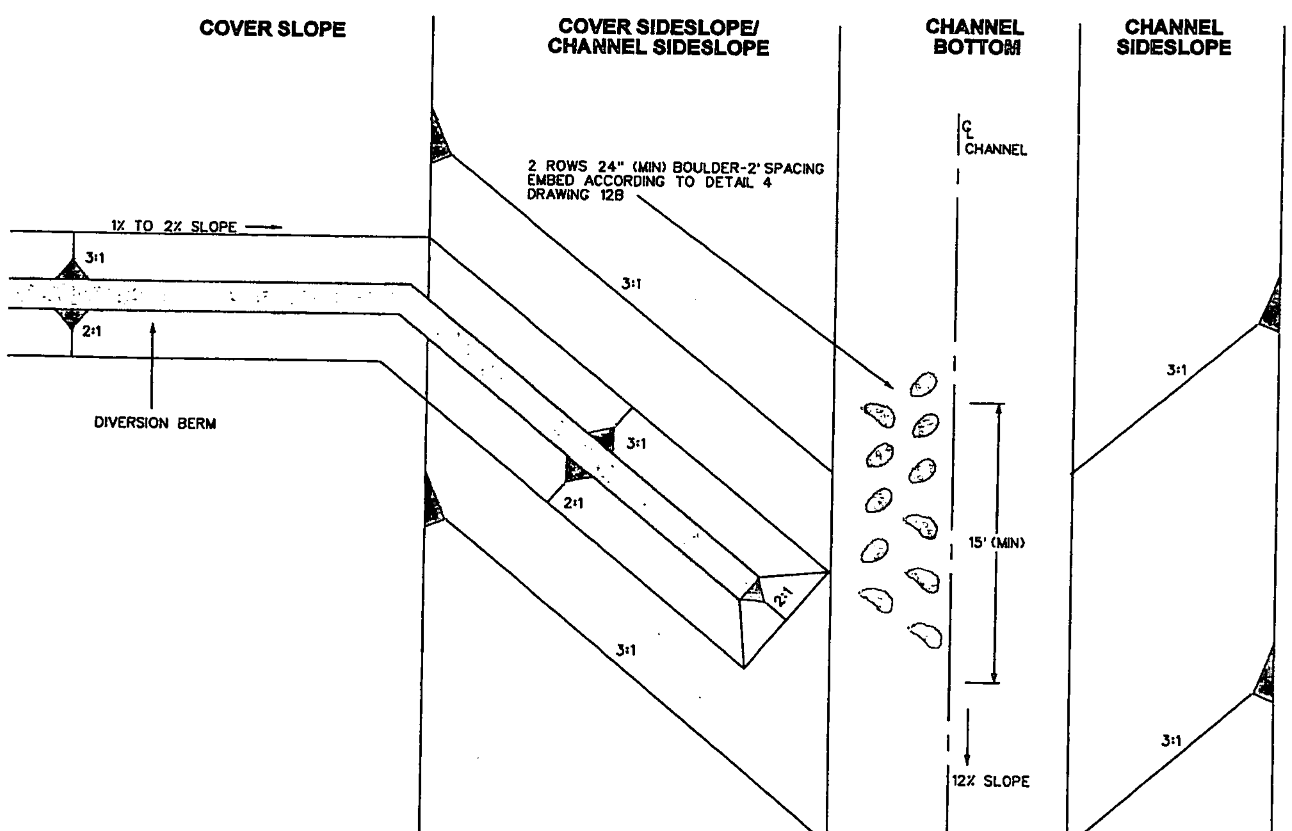


SECTION

NOTE: NAG P550 OR EQUIVALENT EROSION MAT ON CHANNEL BOTTOM AND ALL SIDESLOPES. INSTALL ACCORDING TO MANUFACTURER'S RECCOMENDATIONS.

PERMANENT/GRASS LINED CHANNEL DETAIL (SECTION) 2 9 12A

NTS

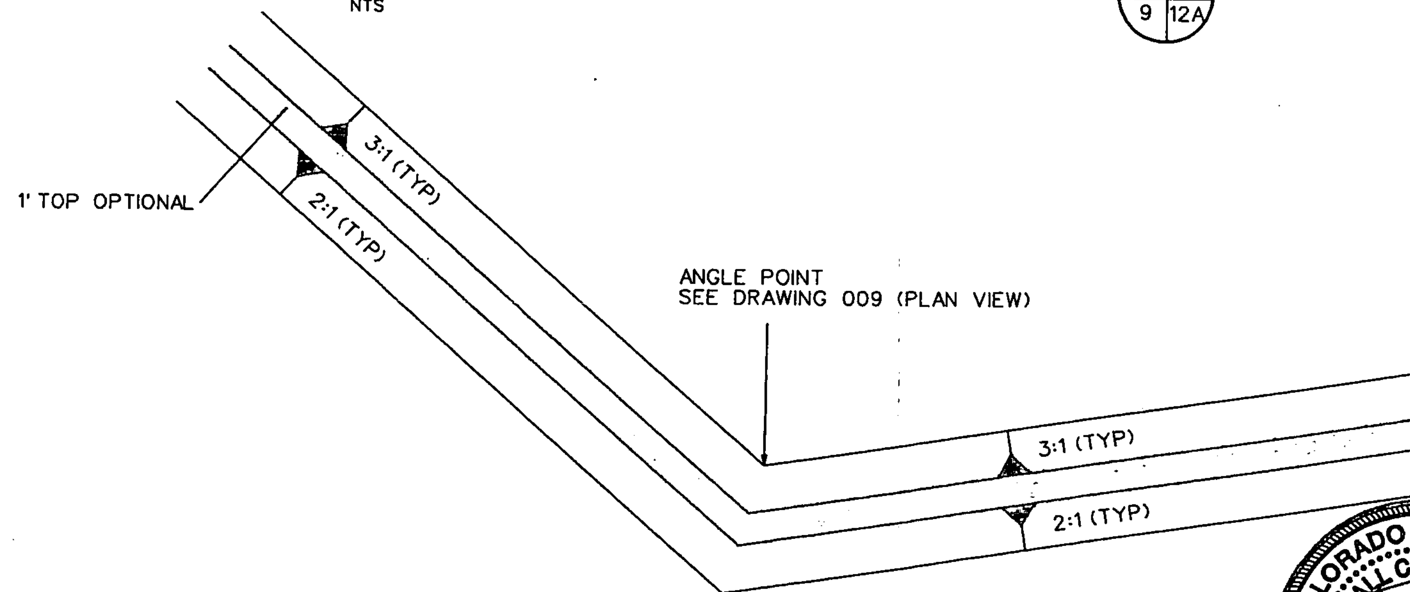


PLAN VIEW

NOTE: NAG P550 OR EQUIVALENT EROSION MAT ON CHANNEL BOTTOM, CHANNEL SIDESLOPES, DOWNSLOPE CHANNEL BOTTOM, AND DOWNSLOPE CHANNEL SIDESLOPES. NAG C125 OR EQUIVALENT ON COVER SLOPE.

DOWNSLOPE CHANNEL TRANSITION FROM DIVERSION BERM TO CHANNEL (PLAN VIEW) 3 9 12A

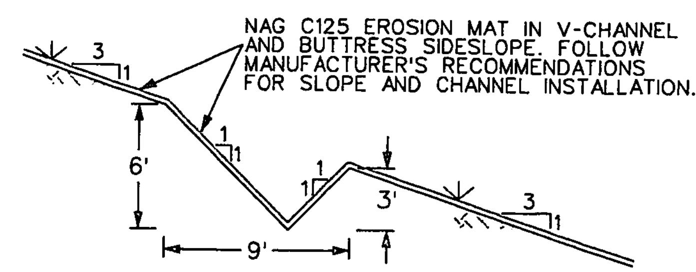
NTS



DIVERSION BERM AT RIDGE LINE (PLAN VIEW) 4 9 12A

NTS

COLORADO REGISTERED PROFESSIONAL ENGINEER RANDALL C. THOMPSON 30638 5/12/05



SECTION

BUTTRESS DIVERSION BERM (V-CHANNEL) 5 9 12A

NTS

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ISSUE	DESIGN COMPANY	DATE	DSGN	DWN	CHKD	IV	APVD	CLASS	PROJECT/CHARGE NO.
0	ORIGINAL ISSUE								57378

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site GOLDEN, COLORADO

KEYWORDS 1. 2. 3. 4. 5.

DESIGNED BY RFA 5/12/05
DRAWN BY AGS 5/12/05
CHECKED BY RCT 5/12/05
INDEPENDENT VERIFIER SRL 5/12/05
APPROVED BY RCT 5/12/05

BLDG/FACILITY SITE — ROOM/AREA NA — GRID COORD/COL NO. NA — NEXT ASSEMBLY NA — SCALE: AS SHOWN

LANDFILL COVER DETAILS SURFACE WATER CONTROLS ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE B — DRAWING NUMBER 51788-012A — ISSUE 0

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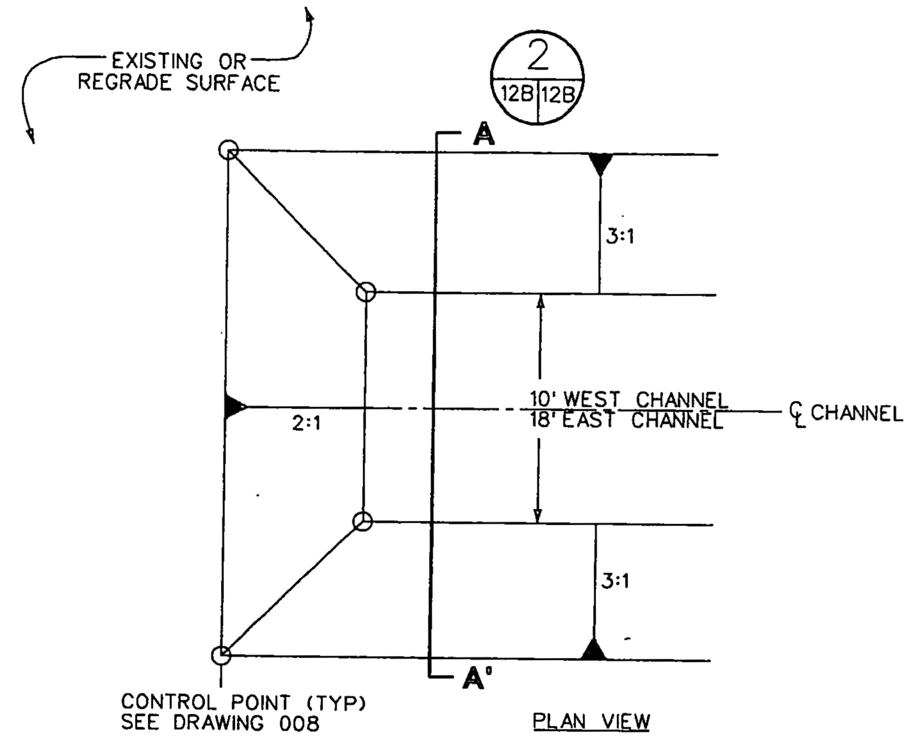
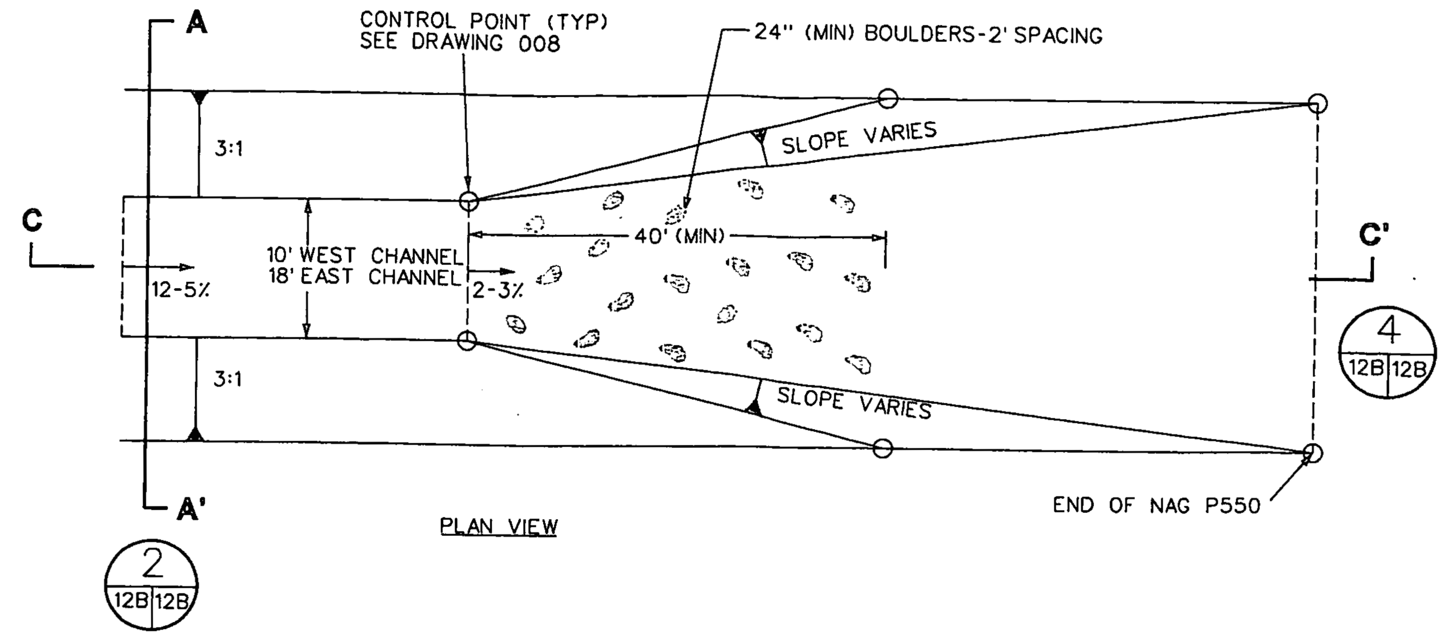
15

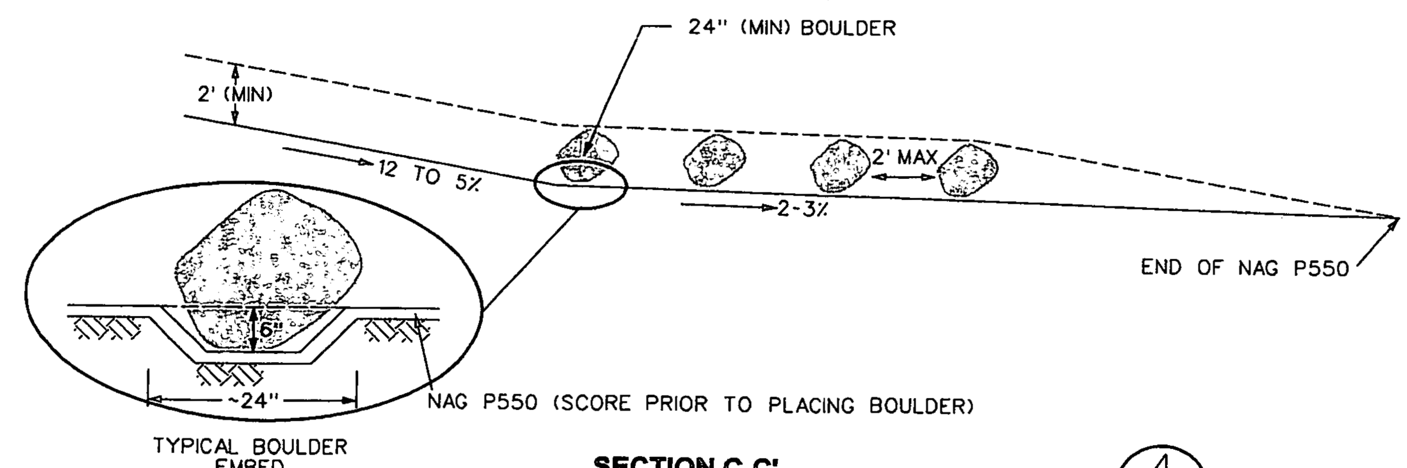


NOTES: NAG P550 OR EQUIVALANT EROSION MAT ON CHANNEL BOTTOM AND ALL SIDE SLOPES. INSTALL ACCORDING TO MANUFACTURER'S RECOMENDATIONS.

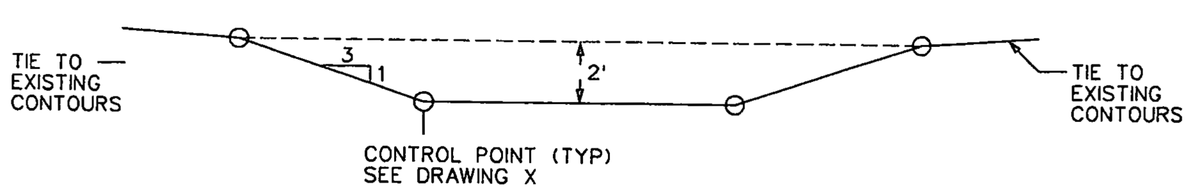
BEGIN CHANNEL (PLAN VIEW) 1 (9 | 12B)
NTS



END CHANNEL (PLAN VIEW) 3 (9 | 12B)
NTS



SECTION C-C' 4 (12B | 12B)
NTS



SECTION A-A' 2 (12B | 12B)
NTS

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30638
5/12/05

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ISSUE	DESIGN COMPANY	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE										

REVISION DESCRIPTION

KEYWORDS: 1. 2. 3. 4. 5.

TOLERANCES: FRACT. ANGLE DEC. : UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

BLDG/FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

DESIGN COMPANY: EARTH TECH
DESIGNED BY: RKA | RA | 5/12/5
DRAWN BY: AGS | | 5/12/05
CHECKED BY: RCT | RT | 5/12/5
INDEPENDENT VERIFIER: JRL | SK | 5/12/5
APPROVED BY: RCT | RT | 5/12/5
CLASSIFIER
LANDLORD

PROJECT/WCF NO. 020525
U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO
Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

LANDFILL COVER DETAILS
SURFACE WATER CONTROLS
ORIGINAL LANDFILL
ACCELERATED ACTION
DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-012B	0

QUAN.	DESCRIPTION	MATERIAL

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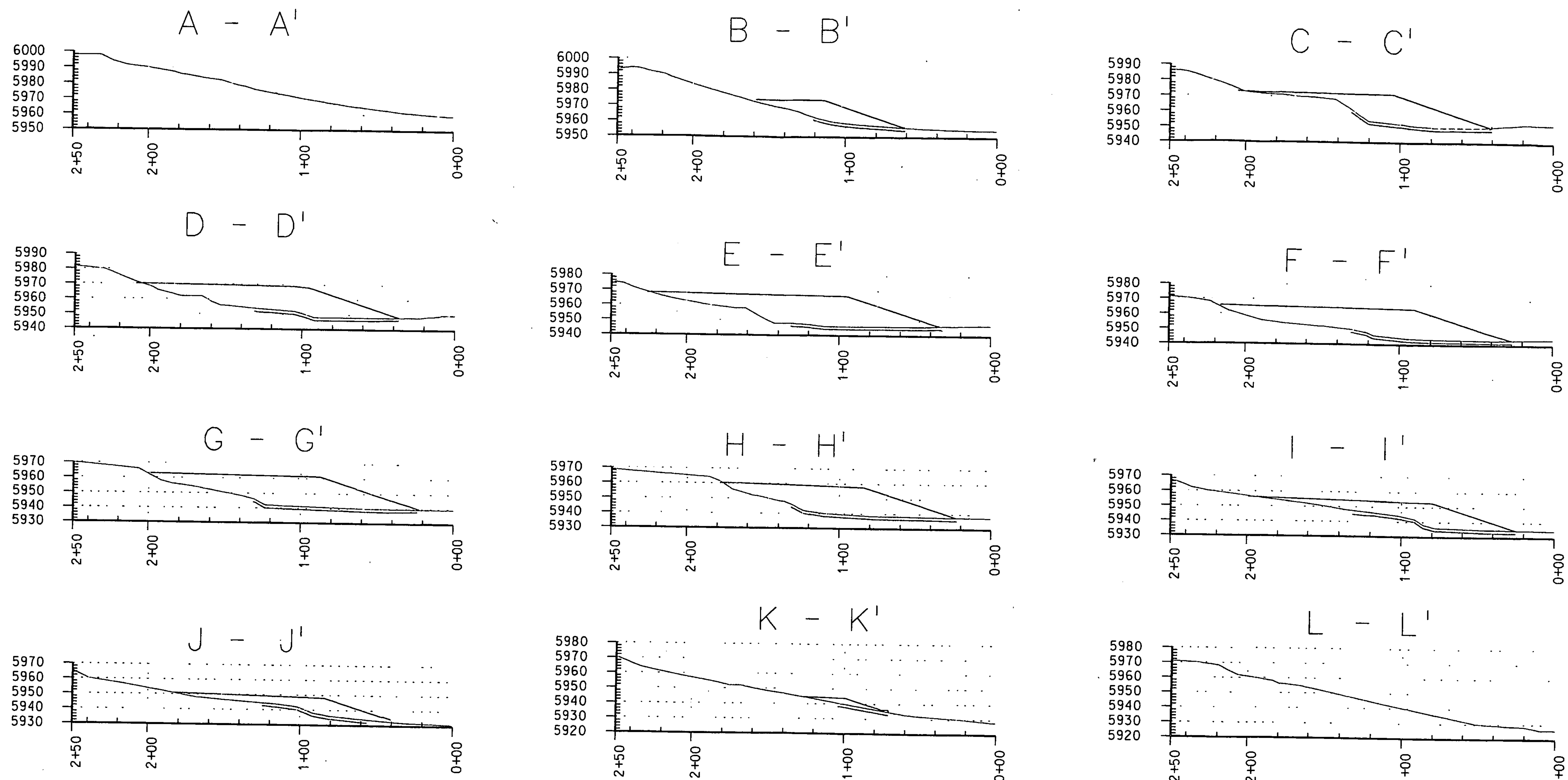
16

QUAN.	DESCRIPTION	MATERIAL



LINE	SURFACE
	Buttress
	Existing Surface
	Existing Surface Dropped 1ft.

Scaled 1.00 Times Ver.
Scaled 1.00 Times Hor.

COLORADO REGISTERED
RANDALL C. THOMPSON
30638
5/12/05
PROFESSIONAL ENGINEER

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ISSUE	EARTH TECH DESIGN COMPANY	DATE	CLASS	37378 PROJECT/CHARGE NO.
0	ORIGINAL ISSUE			
ISSUE	DESCRIPTION			

PROJECT/UCF NO. 020525

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
	FRACT. ±	DESIGNED BY		
1.		RCT	RT	5/12/5
	ANGLE ±	DRAWN BY		
2.	DEC. ±	AGS		5/12/05
3.	UNLESS NOTED OTHERWISE	CHECKED BY		
		REA	RA	5/12/5
4.		INDEPENDENT VERIFIER		
5.	REMOVE BURRS AND SHARP EDGES	SGL		5/12/5
BLDG./FACILITY		APPROVED BY		
		RCT	RT	5/12/5
ROOM/AREA	NEXT ASSEMBLY	CLASSIFIER		
GRID COORD./COL NO.	SCALE: AS SHOWN			

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

BUTTRESS
CROSS SECTIONS

ORIGINAL LANDFILL
ACCELERATED ACTION
DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-013	0

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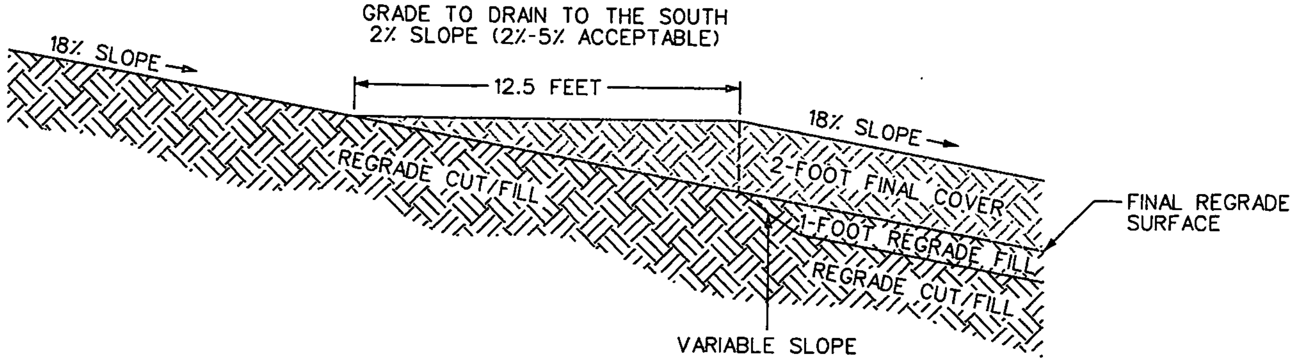
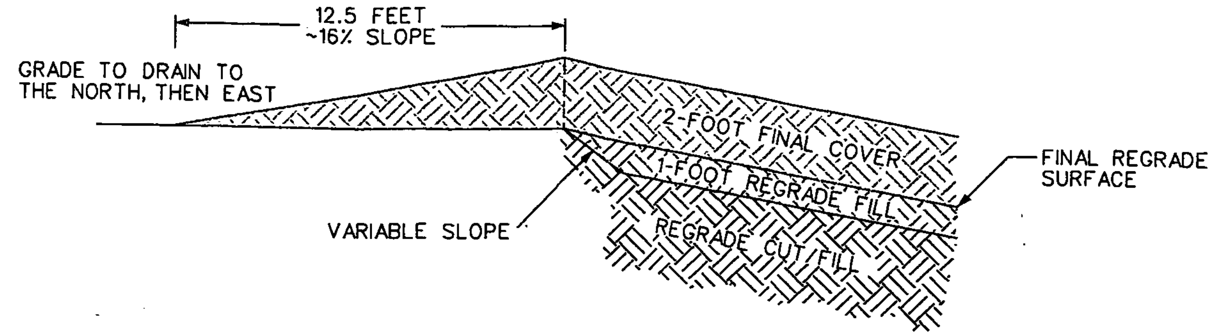
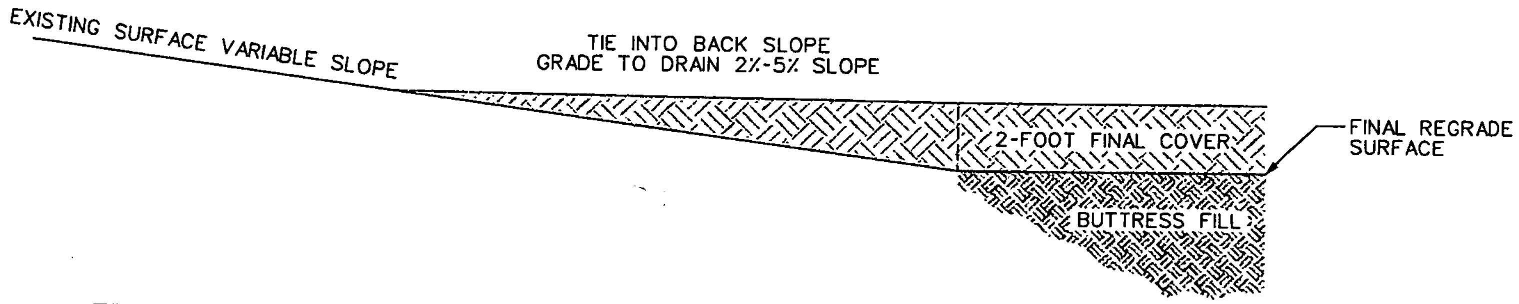


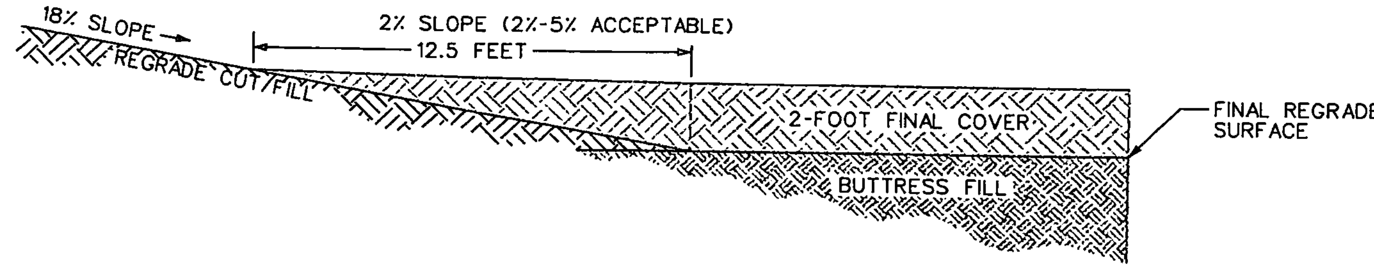
FINAL COVER TIE IN
18% FINAL COVER TO 18% REGRADE SURFACE UPSLOPE
NTS
1 / 7 | 14



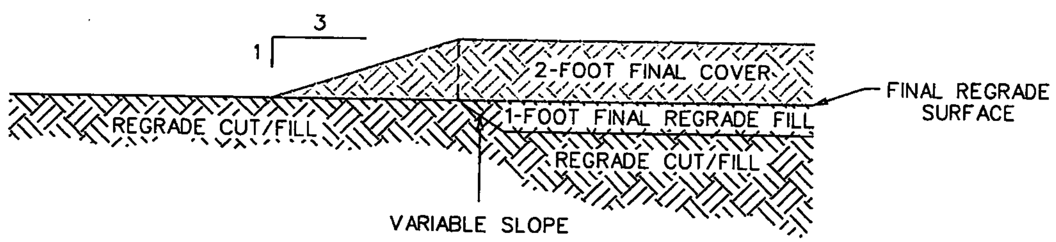
FINAL COVER TIE IN
18% FINAL COVER TO EXISTING CONDITION (NORTH SIDE)
NTS
2 / 7 | 14



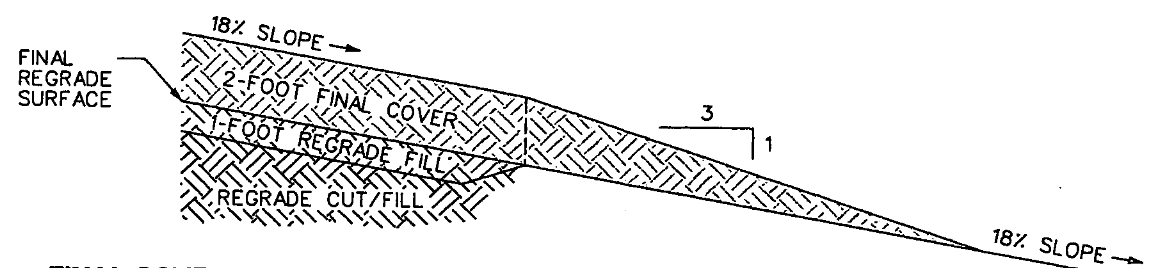
FINAL COVER TIE IN
BUTTRESS (LEVEL) SURFACE TO EXISTING CONDITIONS
NTS
3 / 7 | 14



FINAL COVER TIE IN
BUTTRESS (LEVEL) SURFACE TO 18% REGRADE SURFACE
NTS
4 / 7 | 14



FINAL COVER TIE IN
18% FINAL COVER TO 18% REGRADE SURFACE
CROSS SLOPE (EAST AND WEST)
NTS
5 / 7 | 14



FINAL COVER TIE IN
18% FINAL COVER TO 18% REGRADE SURFACE DOWNSLOPE
NTS
6 / 7 | 14

COLORADO REGISTERED PROFESSIONAL ENGINEER
RANDALL C. THOMPSON
30638
5/12/05

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ISSUE	DESIGN COMPANY	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	57378 PROJECT/CHARGE NO.
0	ORIGINAL ISSUE										

REVISION DESCRIPTION

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS
1.
2.
3.
4.
5.

BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL NO.: NA
TOLERANCES FRACT. ANGLE DEC. UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

DESIGN COMPANY: EARTH TECH
DESIGNED BY: RCT 5/12/5
DRAWN BY: ALS 5/12/05
CHECKED BY: REA 5/12/5
INDEPENDENT VERIFIER: SRL 5/12/5
APPROVED BY: RCT 5/12/5
CLASSIFIER
LANDLORD

FINAL COVER PERIMETER TIE IN DETAILS
ORIGINAL LANDFILL ACCELERATED ACTION DRAFT DESIGN

SIZE: B | DRAWING NUMBER: 51788-014 | ISSUE: 0

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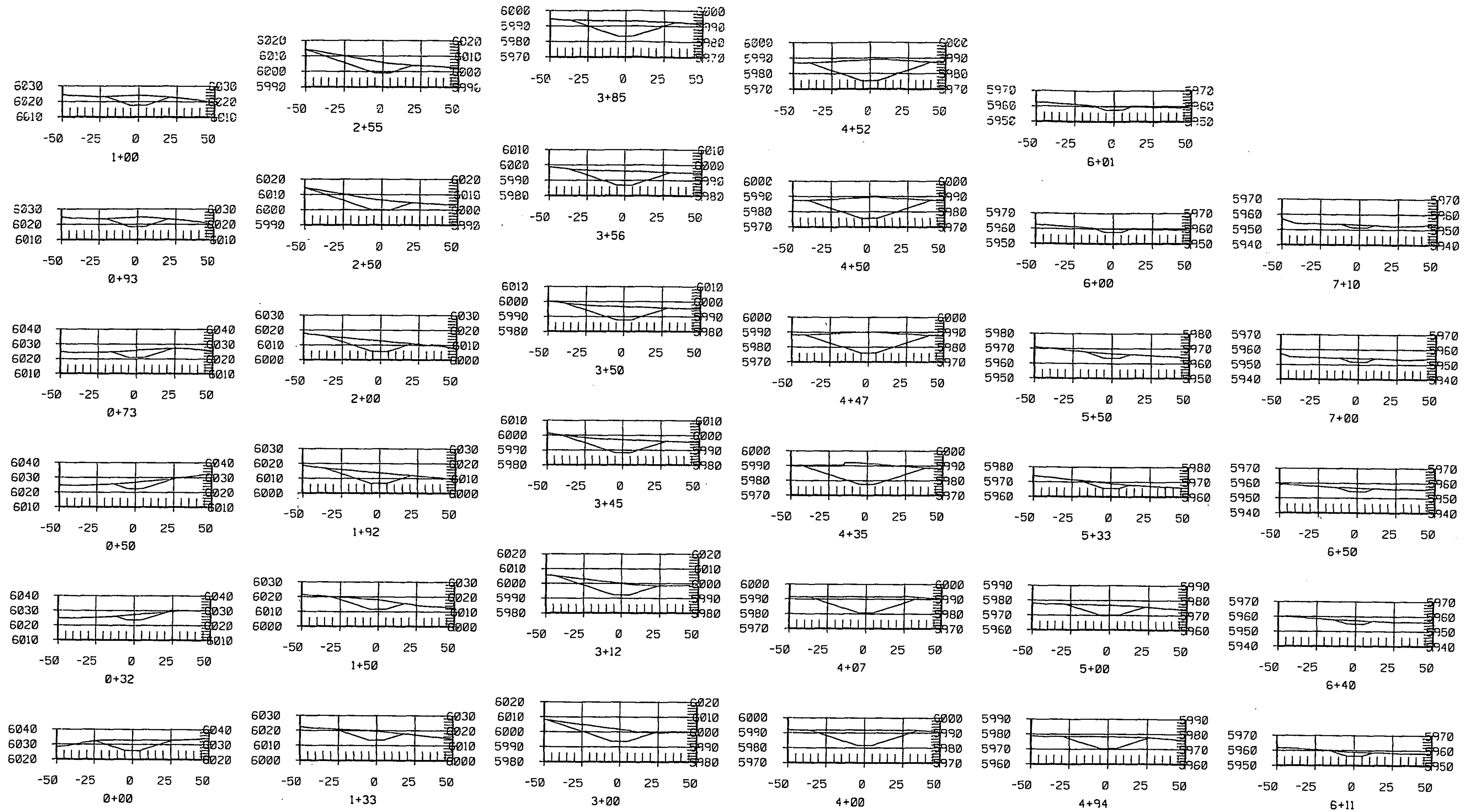
18

QUAN.	DESCRIPTION	MATERIAL



WEST CHANNEL

FINAL COPY

ISSUE	EARTH TECH DESIGN COMPANY	DATE	CLASS	57378 PROJECT/CHARGE NO.
0	ORIGINAL ISSUE			

REVISION DESCRIPTION

PROJECT/WCF NO. 020525

KEYWORDS	TOLERANCES		
1.	FRACT. ±	DESIGN COMPANY: EARTH TECH	
2.	ANGLE ±	DESIGNED BY: KCA	RA 5/12/5
3.	DEC. ±	DRAWN BY: AGS	3/12/05
4.	UNLESS NOTED OTHERWISE	CHECKED BY: RCT	5/12/5
5.	REMOVE BURRS AND SHARP EDGES	INDEPENDENT VERIFIER: SKL	5/12/5
BLDG./FACILITY	NEXT ASSEMBLY	APPROVED BY: RCT	5/12/5
ROOM/AREA		CLASSIFIER	
GRID COORD./COL NO.	SCALE: AS SHOWN		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

TYPICAL WEST CHANNEL
CROSS SECTION FOR CONSTRUCTION

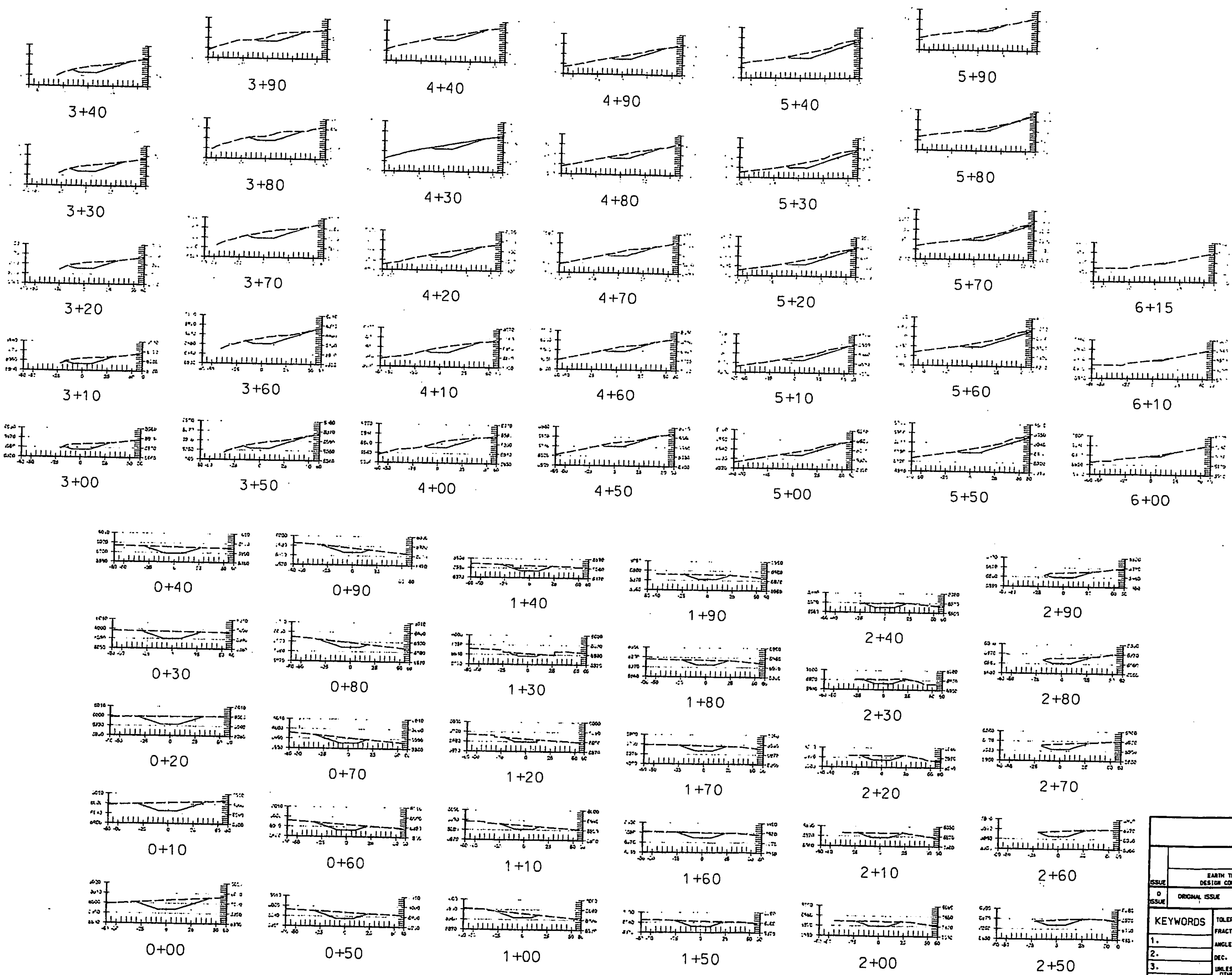
ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-015A	0

GROUP\CAD\ROCKY_FLATS\OLF_2005\Channel\WChannel.dgn Date: 3-2005

19

QUAN.	DESCRIPTION	MATERIAL



EAST CHANNEL

COLORADO REGISTERED
RANDALL C. THOMPSON
30638
5/12/05
PROFESSIONAL ENGINEER

FINAL COPY

ISSUE	EARTH TECH DESIGN COMPANY	DATE	REVISION DESCRIPTION	CLASS	57378 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE		DESCRIPTION		PROJECT/WCF NO. 020525

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
1.	FRACT. ±	DESIGNED BY RGA	RA	5/12/5
2.	ANGLE ±	DRAWN BY AGS		5/12/05
3.	DEC. ±	CHECKED BY RCT		5/12/5
4.	UNLESS NOTED OTHERWISE	INDEPENDENT VERIFIER SRL		5/12/5
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY RCT		5/12/5
BLDG./FACILITY	NEXT ASSEMBLY	CLASSIFIER		
ROOM/AREA				
GRID COORD./COL NO.	SCALE: AS SHOWN			

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

TYPICAL EAST CHANNEL
CROSS SECTION FOR CONSTRUCTION

ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-015B	0

GROUP\CAD\ROCKY_FLATS\Olf_2005\Channel\EChannel.dgn Date: 5-2005

KAISER HILL COMPANY

ACCELERATED ACTION DESIGN FOR THE ORIGINAL LANDFILL ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

FINAL
DESIGN SUBMITTAL

SPECIFICATIONS

Project No. 57378.6040
May 2005

COLORADO REGISTERED PROFESSIONAL ENGINEER
RANDALL C. THOMPSON
30630
5/12/05

EarthTech
A Tyco International Ltd. Company

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DIVISION 1 - GENERAL REQUIREMENTS

SPEC-01100-0972	General Project Definitions
SPEC-01110-0973	Summary of Work
SPEC-01300-0974	Submittal Descriptions
SPEC-01305-0975	Submittal Procedures
SPEC-01310-0976	Construction Surveying
SPEC-01401-0977	Safety, Health, and Emergency Response
SPEC-01440-0978	Contractor Quality Control
SPEC-01720-0979	Project Record Documents
SPEC-01722-0980	Field Engineering

DIVISION 2 - SITE CONSTRUCTION

SPEC-02110-0981	Site Preparation
SPEC-02200-0982	Geotechnical Testing
SPEC-02221-0983	Earthwork
SPEC-02222-0984	Drain Rock
SPEC-02223-0985	Geotextile
SPEC-02227-0986	Erosion Matting
SPEC-02228-0987	Erosion Control
SPEC-02245-0988	Stone and Aggregate Materials
SPEC-02900-0990	Seeding

DESIGN SPECIFICATIONS

DIVISION 1 – GENERAL REQUIREMENTS

Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01100-0972
GENERAL PROJECT DEFINITIONS

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

24

SPEC-01100-0972
GENERAL PROJECT DEFINITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS AND DEFINITIONS

A. Drawings and general provisions of the Subcontract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section, if needed.

B. The following definitions, abbreviations, and acronyms apply to these Specifications:

1. "RFETS" means the Rocky Flats Environmental Technology Site. RFETS is a government-owned facility operated for the US Department of Energy by a primary CONTRACTOR.

2. "DOE" means the U.S. Department of Energy, which owns RFETS.

3. "CONTRACTOR" means the primary CONTRACTOR, i.e., Kaiser-Hill (K-H), L.L.C., which operates RFETS for DOE.

4. "SUBCONTRACTOR" is the construction subcontractor, Envirocon.

5. "SA" means the CONTRACTOR'S Subcontract Administrator, who has overall authority for this subcontract. The Subcontractor Administrator is Mary Kaiser.

6. "CTR" means the CONTRACTOR'S Technical Representative, who is Karen Wiemelt.

7. Construction Responsible Manger (RM) is Mike Keating of K-H.

8. RM is Mike Keating of K-H.

9. "DESIGNER" means the Design Authority responsible for the design package that directs the Work to be done. The DESIGNER is Earth Tech.

10. "IWCP" means Integrated Work Control Program, which is a formal planning method used to implement a set of integrated safety and compliance controls, which address activities that pose a threat to the health and safety of the public, the workers or the environment.

11. "ECR" means Engineering Change Request, which is a change to the contract drawings and/or specifications directed by the CONTRACTOR.

12. Quality assurance (QA)/quality control (QC) firm is Tetra Tech.

13. QA/QC testing company is Advanced Terra Testing under subcontract to Tetra Tech.

14. "ENGINEER: means CONSTRUCTION RM or designee

15. Construction Site Manager is Steve McQueary of Envirocon.

16. "CQAE" means Construction Quality Assurance Engineer.

17. "SQAM" means Site Quality Assurance Manager.

18. "QCSM" means Quality Control Site Manager.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Project consists of the construction of a soil cover and buttress fill at the Original Landfill at the RFETS.

B. Project Location: The RFETS is located near Golden, Colorado. See contract drawings for Vicinity and Area Plot plan.

1.03 CONTRACT, DRAWINGS AND SPECIFICATIONS

A. SUBCONTRACTOR will be furnished, without charge, sets of specifications, full-size (ANSI D) drawings, and half-size (ANSI B) drawings. A drawing list, which constitutes a part of the subcontract documents, shall include the Drawing Number, Revision Number, and Drawing Title. The SUBCONTRACTOR shall observe, and so caution any of its subcontractors, that the scales on the half-size drawings are not correct and are not usable for material take-offs.

1. Specification Format: The Construction Specification Institute (CSI) Specifications are organized into Divisions and Sections using the 16-division format and CSI "MasterFormat" number system.

2. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents.

B. If any conflicting information is found between drawings and specifications, the specifications shall overrule the drawings. SUBCONTRACTOR shall report any such conflicts to the Construction RM as soon as they are discovered.

1.04 WORK SEQUENCE

A. The Work may be conducted in phases, as proposed by the SUBCONTRACTOR and approved by the Construction RM.

B. Progress Schedules

1. The SUBCONTRACTOR shall develop a progress schedule for review and approval by the CONTRACTOR. The schedule shall be in a sufficiently detailed Critical Path Method format and shall be updated on a weekly basis unless otherwise directed in writing by the CONTRACTOR.

1.05 MISCELLANEOUS PROVISIONS

A. Change Control – All project changes that occur during construction shall be documented. Several forms of written communications shall be utilized to provide direction and document field changes during the contract:

1. Request for Information (RFI) - Design clarifications are to be documented with the RFI process. The SUBCONTRACTOR shall submit the RFI to the Design RM and the DESIGNER in accordance with the Construction Quality Assurance/Quality Control Plan. RFIs for scope of work clarifications may not need approval from the DESIGNER if the intent of the approved design is not changed.

2. Engineering Change Request (ECR) will be issued by the SUBCONTRACTOR or CONTRACTOR to the DESIGN ENGINEER. The ECR will be reviewed by the RM prior to sending to the DESIGNER for resolution. The DESIGNER will resolve the issue and return a signed copy of this ECR to the RM. The CDPHE project representative will review the ECR and approve/comment.

3. Field change will include small alignment changes of the diversion berms, perimeter channels, regrade waste, regrade fill, and cover limits.

4. Redlined Drawings - The SUBCONTRACTOR shall maintain one (1) current set of subcontract redlined specifications and drawings at the construction site. The SUBCONTRACTOR shall redline all changes not reflected in contract documents modified by ECRs or RFIs. The SUBCONTRACTOR shall provide to the CONTRACTOR one (1) complete set of full-size redline drawings and other documents (specifications) at the completion of the project.

B. Supervision - The SUBCONTRACTOR is required to have a full-time, non-working superintendent on-site while any work is being performed.

C. Plan of Operations - In general, there will be no stipulated sequence of construction, except for certain specific activities identified in the Planning Section of the IWCP. The SUBCONTRACTOR shall arrange his schedule such that, when work is started, work will proceed promptly and vigorously to completion.

D. Meetings - SUBCONTRACTOR'S representative will be required to attend the following meetings:

1. Pre-construction Indoctrination / Kick-off meetings

2. Weekly progress meetings

3. Periodic meetings as required to resolve issues or discuss potential changes.

4. Plan of the Day / Pre-evolution meeting

5. Representatives of lower-tier subcontractors may be required to attend some of the meetings, depending upon the meeting agenda.

E. QSCM will be on-site during all work activities relating to design. Activities supporting construction (i.e., equipment fueling, repair, maintenance, etc.) will not require QCSM on site.

PART 2 PRODUCTS

A. Products required for the work are identified in the Specifications and Drawings.

PART 3 EXECUTION (Not Applicable)

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01110-0973
SUMMARY OF WORK

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-01110-0973
SUMMARY OF WORK

PART 1 GENERAL

1.01 PROJECT DESCRIPTION

A. Work covered by these Specifications and Design Drawings comprises the construction of a soil cover and buttress fill at the Original Landfill at the Rocky Flats Environmental Technology Site (RFETS), Golden, Colorado. Major items of the work include, but are not limited to:

1. Mobilization and site preparation, to include, but not be limited to:

a. Preparation of storage areas, laydown areas, temporary soil stockpile areas, operations support areas, and access roads.

b. Placement of access control fencing, if needed.

c. Establishing protected site survey benchmarks to provide for readily accessible horizontal and vertical control points, if needed.

d. Establishing of temporary haul roads.

e. Removing trees.

f. Empting geotechnical investigation soil from 55-gallon drums. Drums are to be disposed within the landfill limit-of-waste footprint.

2. Preparation of the existing interim cover surface, to include, but not be limited to:

a. Staking and protection of any monitoring wells designated by the CONTRACTOR to remain after completion of the soil cover and buttress fill.

b. Clearing and grubbing in accordance with Specification Section 02110 SITE PREPARATION.

3. Execution of a constructibility assessment or test pad. Prior to placing components of the regrade material, the SUBCONTRACTOR will establish acceptable procedures for placement of the material and demonstrate the procedures by executing a constructibility assessment pad on a small portion of the landfill. The test pad will be constructed of regrade material. Standard Proctor tests will be used on buttress fill materials and therefore a test pad is not necessary. The test fill area will have a width at least four times the equipment width and a length at least twice the equipment length. The procedures used to construct the

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assessment area will demonstrate conformance with the final design specification requirements. The Colorado Department of Public Health and Environment (CDPHE) and the U.S. Environmental Protection Agency (EPA) will have the opportunity to informally evaluate this procedure prior to its use by the SUBCONTRACTOR. Once construction procedures are demonstrated that provide compliance with the specifications, the procedures will be used throughout the placement of these regrade soils and cover soils with the intent being to obtain a uniform placement and compaction of the soils within the parameters for compaction set by the final design.

4. Buttress fill placement will consist of sub-excavation to competent material followed by placement of geosynthetics (if necessary) and drain rock to design grades. Buttress fill material will then be placed to complete the buttress fill.

5. Regrade cut area of waste and place in lower portions of fill areas. All waste material must remain inside the existing waste boundary. If waste is encountered outside the current waste boundary, the waste will be relocated within the current waste boundary or the two-foot-thick soil cover will be extended over the area. Confirmation of extent will be visual.

6. With imported Rocky Flats Alluvium (RFA) material, regrade the surface as shown in the Design Drawings and in accordance with the test pad procedures discussed in Step 3. This will establish the base grade for soil cover placement.

7. Placement of the soil cover, to include but not be limited to:

    a. Placing a 24-inch layer of RFA soil directly onto the regrade surface. To minimize compaction, place full 24-inch thickness at once.

    b. Establish surface run-off controls as per the final design package, and install erosion control materials (erosion matting and riprap).

    c. Revegetation and erosion control will be performed as per specifications.

8. Demobilization. This activity will occur throughout the project as various activities are completed and equipment is no longer needed.

1.02 SUBCONTRACTOR'S USE OF PREMISES

A. SUBCONTRACTOR shall confine operations to areas within limits described in the Programmatic Biological Assessment. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed without approval of United States Fish and Wildlife Service and RFETS Ecology.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

*****END OF SECTION*****

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Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01300-0974
SUBMITTAL DESCRIPTIONS

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-01300-0974
SUBMITTAL DESCRIPTIONS

PART 1 GENERAL

1.01 SUBMITTALS

A. The submittals described below are those required and further described in other sections of the Specifications. Other requirements pertaining to submittals are included in the SPECIAL CLAUSES and Section 01305 SUBMITTAL PROCEDURES.

1. Data. Submittals that provide calculations, descriptions, or documentation regarding the work.

2. Drawings. Submittals that graphically show the relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

3. Instructions. Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data Sheets, if any, concerning impedances, hazards, and safety precautions.

4. Schedules. Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

5. Statements. A document required by the vendor or through the vendor from a supplier, installer, manufacturer, or other lower-tier vendor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

6. Reports. Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified, and test results shall be recorded.

7. Certifications. Statements signed by an official authorized to certify on behalf of the manufacturer of a product, system or material attesting that the product, system or material meets specified requirements. The statement must be dated after the award of this contract, must state the vendor's name and address, must name the project and location, and must list the specific requirements that are being certified.

8. Samples. Samples, including both fabricated and non-fabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

9. Records. Documentation to record compliance with technical or administrative requirements.

10. Operation and Maintenance Manuals. Data that form a part of an operation and maintenance manual.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 Submittals prepared pursuant to this specification shall be prepared in accordance with Section 01305 SUBMITTAL PROCEDURES.

3.02 Submittals are required for the following materials:

A. Regrade material (RFA)

B. Soil cover material (RFA)

C. Buttress fill material (engineered fill)

D. Geosynthetic materials

E. Drain rock

F. Seeding

G. Erosion Matting

3.03 Detailed construction schedule.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01305-0975
SUBMITTAL PROCEDURES

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-01305-0975
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY (Not Applicable)

1.02 REFERENCES (Not Applicable)

1.03 RESPONSIBILITIES

A. SUBCONTRACTOR and CONTRACTOR Responsibilities

The SUBCONTRACTOR is responsible for management of his work, including scheduling, control, and submittals. The CONTRACTOR and SUBCONTRACTOR shall review each submittal for contract compliance. Submittals that do not conform will be returned to the originator to be corrected. A Submittal Register will be utilized to log and monitor all submittal activities. The SUBCONTRACTOR shall perform a check to ensure that all materials and/or equipment have been tested, submitted and approved during the preparatory phase of quality control inspections.

B. CONTRACTOR Responsibilities

The CONTRACTOR will review submittals for approval and approve those that conform to contract requirements. The approval of submittals by the CONTRACTOR shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the SUBCONTRACTOR of the responsibility for any error that may exist, as the SUBCONTRACTOR under the construction quality control (CQC) requirements of this contract is responsible for the dimensions and design of adequate connections, details and satisfactory construction of all work.

1.04 DISAPPROVED SUBMITTALS

A. The SUBCONTRACTOR shall make all corrections required by the CONTRACTOR and promptly furnish a corrected submittal in the form and number of copies as specified for the initial submittal.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 GENERAL

A. The SUBCONTRACTOR shall prepare the Submittal Register (see the Construction QA/QC Plan for example Submittal Register form). The CONTRACTOR may request submittals in addition to those listed when deemed necessary to adequately describe the work covered in the respective sections. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with all contract requirements. Prior to submittal, all items shall be checked and approved by the

SUBCONTRACTOR, and each respective Transmittal Form shall be signed and dated by the SUBCONTRACTOR certifying that the accompanying submittal complies with all the contract requirements (see the Construction QA/QC Plan for example Transmittal Form). Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: SUBCONTRACTOR'S, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; operation and maintenance (O&M) manuals, including parts lists; certifications; warranties and other such required submittals. Submittals requiring approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby.

3.02 SUBMITTAL PROCEDURE

A. All items listed on the Submittal Register shall be provided directly to the CONTRACTOR.

B. All catalog and descriptive data shall be submitted in three (3) copies. Catalog cuts and other descriptive data which have more than one model, size, or type or which shows optional equipment shall be clearly marked to show the model, size, or type and all optional equipment that is proposed for approval. Submittals on component items forming a system or that are interrelated shall be submitted at one time as a single submittal to demonstrate that the items have been properly coordinated and will function as a unit.

1. Certificates of Compliance

Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing company and shall contain the name and address of the CONTRACTOR, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the CONTRACTOR from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

2. Deviations

The SUBCONTRACTOR shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The CONTRACTOR/ ENGINEER reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.03 CONTRACTOR-APPROVED SUBMITTALS

A. Upon completion of review of submittals, the submittals will be identified as having received approval by being so stamped and dated.

B. The drawing print and three (3) sets of all catalog data and descriptive literature will be given to the CONTRACTOR. After approval, the CONTRACTOR will return one to the SUBCONTRACTOR.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01310-0976
CONSTRUCTION SURVEYING

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-01310-0976
CONSTRUCTION SURVEYING

PART 1 GENERAL

1.01 SUMMARY

A. CONTRACTOR Responsibilities

1. Vertical and horizontal control shall be established by CONTRACTOR in the form of benchmarks prior to starting work at the project site. CONTRACTOR shall choose which type of surveying equipment to use (GPS, Total Station, etc.). All construction staking shall be the responsibility of CONTRACTOR. In addition, CONTRACTOR shall be responsible for reviewing all construction staking with ENGINEER and CONTRACTOR to identify the features staked.

2. Survey work shall be performed under the direction of a Professional Land Surveyor registered in the State of Colorado.

B. Primary Control Monuments

1. Established benchmarks shall be verified by CONTRACTOR to establish primary vertical and horizontal control for Work.

1.02 SUBMITTALS

A. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS and Section 01305 SUBMITTAL PROCEDURES:

1. Record Surveys.

PART 2 PRODUCTS

2.01 RECORD SURVEYS

A. Record surveys for the surfaces and layer thicknesses will include the information and details as described in the Construction QA/QC Plan. These surveys must be stamped by a Colorado licensed land surveyor and submitted to the CONTRACTOR for final acceptance.

PART 3 EXECUTION

3.01 BENCHMARKS

A. Permanent horizontal/vertical control monuments will be established at the landfill site, as appropriate.

3.02 CONSTRUCTION LINE AND GRADE

A. CONTRACTOR shall bear sole responsibility for correct transfer of construction lines and grades from benchmarks for the correct alignment and grade of completed Work based on lines and grades shown on Drawings. CONTRACTOR shall establish vertical and horizontal reference control stakes in the proximity of the work.

1. Survey Reporting

   Vertical Surveys shall be reported to the nearest 0.1 foot. Horizontal surveys shall be reported to the nearest 0.1 foot.

2. Datum for Control

   Horizontal coordinates shall be based on the State Plane coordinate system. Elevations shall be based on Mean Sea Level NAV 88.

3. Construction Staking and Record Surveys

   a. Rough cut/fill stakes shall be set as needed when SUBCONTRACTOR starts construction. SUBCONTRACTOR may use laser-guided equipment.

   b. Record surveys for the required layers shall be performed as described in the Construction QA/QC Plan.

3.03 SURVEYED ITEMS

A. Record surveying will be conducted at a minimum to support the production of the following as-built record drawings. Horizontal tolerance shall be ±0.2 foot:

   1. Top of regrade surface (vertical tolerance of ±0.2 foot).

   2. Top of soil cover surface (vertical tolerance of –0 to +0.2 foot).

   3. Top and extent of buttress fill (vertical tolerance of ±0.2 foot).

   4. Buttress fill density test locations (vertical tolerance of ±0.2 foot).

   5. Centerline of channels.

   6. Centerline of diversion berms.

   7. Final project completion site topographic map including division berms, buttress, and perimeter channels.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01401-0977
SAFETY, HEALTH, AND EMERGENCY RESPONSE

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-01401-0977
SAFETY, HEALTH AND EMERGENCY RESPONSE

PART 1 GENERAL

1.01 SUMMARY

A. Safety, health and emergency response shall be as detailed in the below-referenced plan. All work performed under the project shall comply with all applicable federal, state and local safety and occupational health rules and regulations.

1.02 REFERENCES (NOT APPLICABLE)

1.03 GENERAL REQUIREMENTS

A. Safety, health and emergency response requirements shall be as detailed in the RFETS Occupational Safety and Industrial Health Program Manual.

B. Construction Project Safety and Health Management, which includes the following elements:

1. Job Hazard Analysis (JHA). The JHA shall identify the project-specific hazards and controls that will be implemented.
2. Personal Protective Equipment. The JHA and Radiological Work Permit (RWP) shall identify the required project-specific personal protective equipment (PPE).
3. Personnel Monitoring. The JHA shall describe the personnel monitoring (e.g., dust) activities that will be performed by the SUBCONTRACTOR during construction activities.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01440-0978
CONTRACTOR QUALITY CONTROL

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

SPEC-01440-0978
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Quality control shall be as described in the plans referenced below.

1.02 REFERENCES

A. EPA, 1993, Technical Guidance Document Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93-182.

1.03 GENERAL REQUIREMENTS

A. Quality control requirements shall be as detailed in the project-specific Construction Quality Assurance/Quality Control Plan of the Accelerated Action for the Original Landfill.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 GENERAL

A. Quality control actions shall be performed by the CONTRACTOR and SUBCONTRACTOR as detailed in the Construction Quality Assurance/Quality Control Plan, of the Accelerated Action for the Original Landfill.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01720-0979
PROJECT RECORD DOCUMENTS

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-01720-0979
PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Maintain at site one record copy of:

1. Redlined Drawings and Specifications.
2. Work control documents.
3. Addenda.
4. Approved submittals.
5. Field test records.
6. Associated permits.
7. Certificates of inspection and approvals.
8. Request for Information.
9. Engineering Change Request.

1.02 SUBMITTALS

A. General

1. At Substantial Completion:

a. Deliver one set of as-built construction Drawings and Specifications to CONTRACTOR for use in preparation of the construction project record file for the project components listed in Specification Section 01310 CONSTRUCTION SURVEYING.

B. Transmittal Letters

1. Accompany submittals with transmittal letter containing following:

a. Date.

b. Project title and number.

c. SUBCONTRACTOR'S name and address.

d. Title of record document.

e. Signature of SUBCONTRACTOR or authorized representative.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 RECORD DOCUMENTS

A. Alterations - Maintain record set of Design Drawings and Specifications legibly annotated to show all changes made during construction.

1. Graphically depict changes by modifying or adding to plans, details, or sections. Changes in horizontal location and associated elevations shall be transmitted to the CONTRACTOR via the survey data; however, obvious changes to the plans shall be noted on the Design Drawings with reference to survey data providing more precise information.

2. Make changes on each sheet affected by changes.

3. Do not conceal work until required information is recorded.

4. Record changes made by RFI, or Engineering Change Request.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 1

SPEC-01722-0980
FIELD ENGINEERING

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

SPEC-01722-0980
FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

A. All survey control work will be performed by the CONTRACTOR. CONTRACTOR shall choose which type of surveying equipment to use (GPS, Total Station, etc.). All surveys will be performed under the direction of a Licensed Surveyor in the State of Colorado and in accordance with all applicable surveying codes.

1.02 PRIMARY CONTROL MONUMENT

A. Bench marks, monuments or references provided by CONTRACTOR to establish primary vertical control for Work are indicated on Drawing 51781-004.

B. Protect and maintain primary control monuments shown on Drawings throughout Project area.

1.03 PRIMARY LINE AND GRADE

A. Primary line and grade will be provided by CONTRACTOR and established by SUBCONTRACTOR by means of stakes placed at site of Work.

B. Stakes for construction will be set:

1. **50 ft x 50 ft** grid lines over Project Site or as directed by Construction RM.
2. At changes in grade.
3. Offset to best serve SUBCONTRACTOR.

C. Stakes for excavation and embankment will be set:

1. Parallel to toe of slope at **50** ft intervals or as directed by Construction RM.
2. Offset to best serve SUBCONTRACTOR.

D. SUBCONTRACTOR shall:

1. Provide assistance as required.
2. Arrange operations to avoid interference with establishment of primary lines and grades.
3. Check accuracy of line and grade by visual inspection, checks between stakes, and periodic checks (with surveying equipment) between primary control monuments and stakes.
4. Protect and preserve stakes.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

*****END OF SECTION*****

DESIGN SPECIFICATIONS

DIVISION 2 – SITE CONSTRUCTION

Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02110-0981
SITE PREPARATION

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-02110-0981
SITE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Protection.

3. Clearing and grubbing.

1.02 DEFINITIONS

A. Structures

1. Existing structures including buildings, pavements, signs, posts, fences, and other miscellaneous items.

B. Utilities

1. Existing gas mains, water mains, steam lines, electric lines and conduits, telephone and other communication lines, pole, and conduits, sewer pipe, cable television, other utilities, and appurtenances.

C. Clearing and Grubbing

1. Cutting and disposing of trees, brush, windfalls, logs, grasses, and other vegetation, and removing and disposing of roots, stumps, stubs, grubs, logs, and other timber.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 PROTECTION

A. Existing structures and utilities shall be protected against damage. The SUBCONTRACTOR shall contact the CONTRACTOR for marking (or verifying) utility locations before beginning excavation. If uncharted utilities are encountered during excavation, stop work in the immediate area or as appropriate and notify CONTRACTOR and the appropriate utility provider.

B. The SUBCONTRACTOR shall preserve and protect groundwater-monitoring wells.

3.02 CLEARING AND GRUBBING

A. The SUBCONTRACTOR shall remove vegetation and incorporate with the grade fill within defined limits of waste boundary, as shown on the design drawings, at the location(s) specified by the CONTRACTOR. Vegetation to be removed and incorporated includes grasses and other perishable or degradable organic matter. Settlement calculations include an assumption of waste material at a mid-level organic content; therefore, leaving some grubbed material within the regrade material is acceptable.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02200-0982
GEOTECHNICAL TESTING

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

SPEC-02200-0982
GEOTECHNICAL TESTING

PART 1 GENERAL

1.01 SUMMARY

A. Specifications and guidelines for the geotechnical testing of the soils to be used during construction. Soils to be tested include:

1. Regrade material (Rocky Flats Alluvium)

2. Buttress fill material

3. Soil cover material (Rocky Flats Alluvium)

B. All activities performed by the SUBCONTRACTOR shall be in accordance with all applicable Federal, State, and local laws and regulations.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. D 422 Standard Test Method for Particle Size Analysis of Soils

2. D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (Standard Proctor)

3. D 4318B Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

4. D 5519 Standard Test Method for Particle Size Analysis of Natural Man-Made Riprap Materials

B. Relevant Publications:

1. U.S. EPA (2002), *Technical Guidance for RCRA/CERCLA Final Covers.*

2. U.S. EPA (1993), *Technical Guidance Document, Quality Assurance and Quality Control for Waste Containment Facilities* EPA/600/R-93/182.

3. R.M. Koerner (1999), *Designing with Geosynthetics.*

1.03 DEFINITIONS

A. CONTRACTOR – Kaiser-Hill Company, L.L.C.

B. CTR – Contractor Technical Representative

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C. Geotechnical Laboratory (TESTING LABORATORY) - Party, which is independent from the MANUFACTURER, responsible for conducting laboratory tests on samples prior to construction, under the direction of the CONTRACTOR.

D. SUBCONTRACTOR – Company performing construction activities.

1.04 SUBMITTALS

A. The SUBCONTRACTOR will prepare the following submittals for review by the CONTRACTOR, the Quality Control Site Manager (QCSM), and Construction Quality Assurance Engineer (CQAE) in accordance with Section 01305 SUBMITTAL PROCEDURES:

1. Prior to and after testing:

a. Information from the selected quarry or borrow area for the Rocky Flats Alluvium. At a minimum, location, quantity, and geotechnical data.

b. Information from the selected quarry or borrow area for the buttress fill material. At a minimum, location, quantity and geotechnical data.

c. TESTING LABORATORY results for the tests described in Part 3.03.

2. Submit in accordance with Section 01305 SUBMITTAL PROCEDURES.

1.05 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

A. The SUBCONTRACTOR shall abide by all qualification and submittal requirements of the QA/QC Plan and the Work Control Document(s) (WCD).

B. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC Plan.

PART 2 PRODUCTS

2.01 REGRADE MATERIAL - Soil as defined in Section 02221 and characterized in conformance with Section 02200.

2.02 BUTTRESS FILL MATERIAL - Soil as defined in Section 02221 and characterized in conformance with Section 02200.

2.03 SOIL COVER MATERIAL - Soil as defined in Section 02221 and characterized in conformance with Section 02200.

PART 3 EXECUTION

3.01 SUBMIT MATERIALS TO TESTING LABORATORY

A. Upon consultation with the CONTRACTOR, submit samples from quarry or borrow area to characterize the material. If borrow area is within the RFETS, coordinate sampling effort with CONTRACTOR.

3.02 GEOTECHNICAL TESTS

A. TESTING LABORATORY will conduct the following tests for Buttress fill Material and Soil Cover Material, as defined in Section 02221. Tests to be conducted at frequencies in accordance with the approved QA/QC Plan include:

1. D 422 Standard Test Method for Particle Size Analysis of Soils

2. D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (Standard Proctor) – if applicable

3. D 4318B Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (Atterberg Limits)

4. D 5519 Standard Test Method for Particle Size Analysis of Natural Man-Made Riprap Materials

B. TESTING LABORATORY results to be submitted to CONTRACTOR for possible design modifications.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02221-0983
EARTHWORK

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-02221-0983
EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. This section includes definitions of materials, required submittals, and procedures that will be required to place regrade material, soil cover material, and buttress fill material. Drain rock is covered under Specification Section 02222 DRAIN ROCK.

1.02 DEFINITIONS

A. INTERIM COVER SOILS

Any materials generated from breaking the plane of the existing Interim Cover of the landfill for purposes of manipulating the surface contours or elevations of the Interim Cover in order to establish initial slopes or contours required in accordance with the design drawings.

B. REGRADE MATERIAL

Rocky Flats Alluvium (RFA) soil from a CONTRACTOR-approved borrow source which does not contain waste materials, ice, organic soils, vegetation, wood, peat, or other unsuitable material as determined by the QCSM. Regrade material shall be a material that is readily capable of being compacted in accordance with the test fill program discussed in Specification Section 01110 SUMMARY OF WORK. The regrade material will be used to reach the slope and contours of the Drawings.

C. BUTTRESS FILL MATERIAL

Soil from a CONTRACTOR-approved borrow source which does not contain waste materials, ice, organic soils, vegetation, wood, peat, or other unsuitable material as determined by the QCSM, and meets gradation listed in Table A of this section. Buttress fill material shall be a material that is readily capable of being compacted as an engineered fill, as defined by geotechnical testing performed in accordance with Section 02200 GEOTECHNICAL TESTING, It will be used to construct the buttress.

D. SOIL COVER MATERIAL

RFA from a CONTRACTOR-approved borrow source.

E. GEOGRID

A biaxial polymeric grid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth to function primarily as reinforcement. Use Tensar BX1200 or equivalent.

1.03 SUBMITTALS

A. The SUBCONTRACTOR will prepare the following submittals for review by the CONTRACTOR in accordance with Section 01305 SUBMITTAL PROCEDURES:

1. Proposed Equipment

2. Geotechnical test results demonstrating soil source compliance with this specification and the Construction QA/QC Plan.

1.04 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

A. The SUBCONTRACTOR shall abide by all qualification and submittal requirements of the QA/QC Plan and the Work Control Document(s) (WCD).

B. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC Plan.

PART 2 MATERIALS

2.01 REGRADE MATERIAL

A. Supply per definition above.

2.02 BUTTRESS FILL MATERIAL

A. Supply per definition above.

2.03 SOIL COVER MATERIAL

A. Supply per definition above.

2.04 GEOGRID

A. Supply per definition above.

B. The SUBCONTRACTOR shall check the geogrid upon delivery to verify that the proper material has been received. The geogrid shall be inspected by the CONTRACTOR to be free of flaws or damage occurring during manufacturing, shipping, or handling.

C. Store to prevent excessive mud or other deleterious materials from coming in contact with and affixing to the geogrid materials and at temperatures above -20 degrees F. Geogrid materials should not be left directly exposed to sunlight for a period longer than recommended by the manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Before commencement of construction of the soil cover, the area shown on the Drawings shall be prepared in accordance with the following:

1. Place temporary erosion protection as required per Section 02228 EROSION CONTROL.

2. Clear and grub in accordance with Specification Section 02110 SITE PREPARATION.

3. The landfill regrade cut and fill depth, thicknesses, and elevations shown in the drawings shall be established in accordance with standard construction staking practice and to tolerances established in this section. and in accordance with Section 01722 FIELD ENGINEERING. All staking shall be maintained as required to support construction activities necessary to establish the landfill regrade surface as portrayed in the project Design Drawings.

4. Assure fill area is not impacted by ice, snow, and/or frozen material prior to beginning placement.

3.02 EXCAVATION/REGRADING

A. Regrade materials will be placed and compacted into the fill areas shown on the drawings.

1. During excavation of materials from or within the existing interim cover of the Landfill, follow all instruction and requirements of the Work Control Document(s) and Radiation Work Permit (RWP) as they relate to the exposure and monitoring of waste, and subsequent decontamination procedures as appropriate.

2. All regraded waste material will be thoroughly compacted with an 825 compactor or similar equipment. All areas where waste has been exposed will be compacted.

3. Placement of REGRADE MATERIAL may be required to maintain positive drainage if excavation extends beyond the limit of excavation shown on the Drawings or below excavation grades shown. Regrade material shall be placed in accordance with Section 3.04 of this Specification and as such to facilitate the placement of overlying fill and cover materials. If saturated soil/material is encountered at a depth greater than 2 feet, placement of bridging materials (e.g., washed rock in excess of 1-1/2 inch minimum dimension) in the area, or other methods approved by the DESIGNER to improve bearing capacity will be performed.

3.03 DEWATERING

A. If dewatering is required, the following procedure shall be initiated:

1. If necessary, provide surface water pumps, hoses and other necessary equipment and labor to keep excavation free of standing water. Water coming in contact with soil shall be collected and disposed per site procedures.

3.04 REGRADE WASTE PLACEMENT

A. For the execution of the waste regrade preparation cut and fill program, the following placement procedure shall be initiated where placement is required:

1. Begin construction of regrade fill at lowest point of fill below grade and construct in layers by spreading and leveling material during placement. Spread individual layers to uniform thickness throughout and approximately parallel with finished grade within current working area of fill placement. Step transition between work areas as filling progresses to prevent vertical joints within fill.

2. Place waste materials in approximately 1-foot lifts within current working area of waste.

3. Compact waste with a minimum of 3 passes of the compaction equipment.

4. Where waste material consists of rock, rubble, or waste material of such size as to render placing in 1-foot layers impractical, material may be placed in layers not exceeding in thickness the approximate average size of larger materials provided individual pieces are so placed that there will be no nesting and voids are filled with smaller soil or waste materials.

5. Do not place frozen materials and do not place materials on frozen surfaces. Frozen materials are defined as soil with a temperature less than 32°F or containing visible ice crystals.

6. Regrade waste material within limits of waste shown on the Drawings.

7. Decontamination of equipment will be evaluated by Industrial Hygiene Staff and Radiological Operations Staff on a case by case basis.

3.05 REGRADE MATERIAL PLACEMENT

A. For the execution of the regrade preparation cut and fill program, the following placement procedure shall be initiated where placement is required:

1. Begin construction of regrade fill at lowest point of fill below grade and construct in layers by spreading and leveling material during placement. Spread individual layers to uniform thickness throughout and approximately parallel with finished grade within current working area of fill placement. Step transition between work areas as filling progresses to prevent vertical joints within fill.

2. Place materials uniformly in maximum 1-foot loose lifts within current working area of fill placement.

3. Compact REGRADE MATERIAL in accordance with the test fill program discussed in Specification Section 01110 SUMMARY OF WORK observed and documented by the QCSM.

4. Maintain lifts to provide positive drainage away from construction.

5. Do not place frozen materials and do not place materials on frozen surfaces. Frozen materials are defined as soil with a temperature less than 32°F or containing visible ice crystals, or clods of frozen soil larger than 4 inches in any direction.

6. Saturated soil shall be spread over an area to receive fill and shall be allowed to air dry to a sufficient state that it may be compacted and may serve as adequate material for placement of overlying fill and cover materials.

7. A minimum of 1 foot of REGRADE MATERIAL will be required to separate waste material from DRAIN ROCK.

3.06 BUTTRESS FILL MATERIAL PLACEMENT

A. For the execution of the buttress fill construction, the following placement procedure shall be initiated:

1. Place buttress fill material in accordance with this Specification and the approved Design Drawings.

2. The footprint surface shall be prepared by stripping and removing vegetation, root matter, and other organics and deleterious materials from the buttress foundation area, as shown on the Drawings. In addition to stripping, soft, unconsolidated fine-grained alluvium materials (such as Unified Soil Classification System CH, CL, and ML materials), particularly highly plastic clays, shall be removed to a firm/dense condition judged suitable for the buttress foundation, as determined in the field during construction by a site engineer or geologist using ASTM D 2488. The final foundation surface shall be in a condition to accept installation of the geogrid per the manufacturer's recommendation and is anticipated to be a relatively dense granular material (such as Unified Soil Classification System SC or GC, SW or SP, or GW or GP materials). The anticipated average excavation depth for foundation preparation is 2 feet. The final excavation depth and requirements are subject to adjustment in the field during construction as determined by a site engineer or geologist. All final foundation surfaces shall be approved by the site engineer or geologist prior to placement of materials for buttress and blanket drain construction.

3. Install Tensar BX1200 or equivalent biaxial geogrid on the base of the sub-excavation per manufacturer's recommendations. The geogrid shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. If more than one strip is necessary, the geogrid strips shall be overlapped and installed per the geogrid manufacturer's recommendations. If repairs are necessary, follow manufacturer's recommendations.

4. Place drain rock according to Specification Section 02222 DRAIN ROCK and Design Drawings.

5. Place materials in 1-foot lifts to accommodate establishing grade of the final surface and to account for settlement due to grading. Ensure that the material

meets the gradation listed in Table A of this section. If necessary, remove larger cobbles and break down clods. In general, the buttress fill material will meet the physical characteristics of the "pit fine" soils detailed in Appendix G of the Design.

TABLE A

Sieve Size	Percent Finer
0.75 in.	100.0
0.375 in.	95 – 100
#4	80 – 95
#10	65 – 80
#20	50 – 65
#40	40 – 55
#60	35 – 45
#100	30 – 40
#200	20 – 30

6. See QA/QC Plan Table 7.1 for buttress fill soil testing requirements.

7. Materials shall be placed at a final compaction of 95 percent standard Proctor dry density (ASTM D698) with a moisture requirement of ±2 percent of the optimum moisture content (OMC) as measured by standard Proctor density (ASTM D698).

8. Where density testing is required by the Specifications, either nuclear density meter, sand cone, or rubber balloon test methods will be used for the field testing of the in-situ dry unit weight and moisture content of the in-place, compacted fill. One sand cone test (ASTM D 1556) or rubber balloon test (ASTM D 2167) and one laboratory moisture content (ASTM D 2216) test will be conducted per 20 nuclear density tests (ASTM D 2922) to calibrate the results of the nuclear density meter. If consistent calibration is demonstrated, frequencies may be reduced. Allowable moisture and dry density correlation deviation limits are presented in the Specifications. Any discrepancies between test results will be resolved by the QCSM and the Site Quality Assurance Manager (SQAM).

9. If an in-place density test result fails to meet the Specifications, a confirmatory test will be performed immediately adjacent to the failed test. If the confirmatory test meets or exceeds the Specifications, a second confirmatory test will be performed at a second location immediately next to the failed test. If the second confirmatory test also meets or exceeds the Specifications, the area will be declared as meeting project Specifications and the confirmatory tests will be reported. If either confirmatory test fails to meet the Specifications, additional testing as defined by the QCSM and SQAM will be performed to identify the limits of the area that does not meet project Specifications. These areas will be reworked or the failing soils will be removed and replaced, and retesting will be performed until passing results are obtained.

3.07 SOIL COVER MATERIAL PLACEMENT

A. For the execution of the final grade preparation program, the following placement procedure shall be initiated:

1. Place soil cover material (RFA) in accordance with this Specification and the approved Design Drawings. The QCSM must verify the underlying surface is clean, free of all foreign substances, is maintained in a satisfactory condition, and accepted by the SQAM prior to the placement of SOIL COVER MATERIAL.

2. Limit construction traffic to avoid over-compaction.

3. Evenly spread materials on the top surface to match final grading requirements as depicted in the Design Drawings using a Caterpillar low-ground pressure (LGP) D-6 bulldozer (or equivalent). The final required thickness of the final cover soil layer will be a minimum of 2 feet. The verification of final thickness will be by surveying. The diversion berms will be constructed at the same time as the cover soil to avoid soil compaction.

3.08 SOIL PLACEMENT FOR DIVERSION BERMS

A. For the construction of the diversion berms, the following placement procedure shall be initiated:

1. Place soil cover material (RFA) in accordance with this Specification and the approved Design Drawings.

2. Limit construction traffic to avoid over-compaction.

3. Evenly spread materials on the top surface to match final grading requirements as depicted in the Design Drawings using a Caterpillar low-ground pressure (LGP) D-6 bulldozer (or equivalent). The diversion berms will be constructed at the same time as the cover soil to avoid soil compaction.

4. Erosion control materials will be placed immediately after construction of the diversion berms as per Design Drawings, Specifications and manufactures recommendations.

3.09 FIELD QUALITY ASSURANCE/QUALITY CONTROL

A. Grade Fill Placement and Compaction

1. In accordance with the Construction QA/QC plan.

B. Tolerances

1. See Specification Section 01310 CONSTRUCTION SURVEYING for tolerances.

C. Final Grades

1. In accordance with the QA/QC Plan, the completed design subgrades shall be surveyed by CONTRACTOR and approved by the QCSM and SQAM before further placement of cover materials.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02222-0984
DRAIN ROCK

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER   DATE

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SPEC-02222-0984
DRAIN ROCK

PART 1 GENERAL

1.01 SUMMARY

A. This Specification section covers the supply, installation, and testing of materials for use in construction of the buttress fill drain rock as indicated in the Design Drawings. All activities performed by the SUBCONTRACTOR shall be in accordance with all applicable Federal, State, and local laws and regulations.

1.02 REFERENCES

A. The publications listed below form a part of the Specification to the extent referenced. The publications are referred to in the text by basic designation only. The most recent version of the referenced test methods shall be used in all cases.

1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

   a. ASTM C 88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

   b. ASTM C 127 Specific Gravity and Absorption of Coarse Aggregates

   c. ASTM C 131 Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

   d. ASTM C 136 Method for Sieve Analysis of Fine and Coarse Aggregates

   e. ASTM D 2938 Standard Test Method for Unconfined Compressive Strength of Intact Rock Core Specimens

1.03 SUBMITTALS

A. The SUBCONTRACTOR will prepare the following submittals for review by the CONTRACTOR and the QCSM in accordance with Section 01305 SUBMITTAL PROCEDURES:

1. Suppliers' Test Results demonstrating compliance with Part 2 of this Specification.

1.04 EQUIPMENT

A. All equipment and tools used in the performance of the work will be subject to approval by the CONTRACTOR before the work is started and shall be maintained in satisfactory working condition at all times.

1.05 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

A. The SUBCONTRACTOR shall abide by all qualification and submittal requirements of the QA/QC Plan and the Work Control Document(s) (WCD).

B. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC plan.

PART 2 PRODUCTS

2.01 DRAIN ROCK

A. Properties:

1. Stone used for drain rock shall be hard, dense, subangular in shape, resistant to weathering, and free from seams, cracks, or other structural defects. The drain rock must be well sorted gravel coarse to fine, falling within the limits of the gradation requirements, given in Table A:

Table A

Sieve Size (inches)	Percent Finer
2	100
1.5	90-100
1	20-55
0.75	0-15
0.375	0-5

2. See QA/QC Table 7.1 for drain rock testing requirements.

B. Control of gradation will be by supplier's sieve analysis in accordance with the QA/QC Plan.

PART 3 EXECUTION

3.01 PREPARATION

A. Areas on which drain rock materials will be placed shall be graded and dressed to lines and grades shown on drawings and in accordance with Section 02110 SITE PREPARATION and Section 02221 EARTHWORK. Eroded or washed out areas shall be repaired prior to placement of material.

3.02 DRAIN ROCK MATERIAL

A. General

1. Drain rock material shall be placed on the approved regrade surface within the limits and thickness shown on the drawings or as staked in the field. See Specification Section 01310 CONSTRUCTION SURVEYING for tolerances.

B. Placement

1. Prior to placement, the QCSM must ensure that the underlying surface is in satisfactory condition and accepted by the SQAM. Drain rock material shall be spread uniformly and approved by QA/QC personnel to the slope lines, thickness, and grades indicated on the Drawings or as directed.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02223-0985
GEOTEXTILE

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER　　　　DATE

SPEC-02223-0985
GEOTEXTILE

PART 1 GENERAL

1.01 SUMMARY

A. CONTRACTOR shall furnish all geotextile, labor, incidental materials, tools, supervision, transportation, and installation equipment necessary for the installation of geotextile, as specified herein, and as shown on the Drawings.

1.02 REFERENCES

A. ASTM D 5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles

B. ASTM D 4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

C. ASTM D 4533 Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles

D. ASTM D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products

E. ASTM D 4491 Standard Test Method for Water Permeability of Geotextiles by Permittivity

F. ASTM D 4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile

G. ASTM D 4354 Standard Practice for Sampling of Geosynthetics for Testing

H. ASTM D 4759 Standard Practice for Determining the Specifications Conformance of Geosynthetics

1.03 SUBMITTALS

A. The SUBCONTRACTOR will prepare the following submittals for review by the CONTRACTOR and the QCSM in accordance with Section 01305 SUBMITTAL PROCEDURES:

1. The SUBCONTRACTOR shall provide the CQAE with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein.

1.04 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

A. The SUBCONTRACTOR shall abide by all qualification and submittal requirements of the QA/QC Plan and the Work Control Document(s) (WCD).

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B. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC plan.

PART 2 PRODUCTS

2.01 GEOTEXTILE

A. The nonwoven needle-punched geotextile specified herein shall be made from polypropylene staple or continuous fiber.

B. The geotextile shall be manufactured from first-quality virgin polymer.

C. The geotextile shall be able to withstand direct exposure to ultraviolet radiation from the sun for up to 15 days without any noticeable effect on index or performance properties.

D. Geotextile shall meet or exceed all material properties listed in Table A.

MARV required for the 8-ounce nonwoven, needle-punched geotextiles are listed in Table A:

Table A

Tested Property	Units	Test Method	Frequency	Value
Mass per unit area	oz/yd^2	ASTM D 5261	90,000 ft^2	8
Grab tensile strength	lb	ASTM D 4632	90,000 ft^2	205
Grab elongation	%	ASTM D 4632	90,000 ft^2	50
Puncture Strength	lb	ASTM D 4833	90,000 ft^2	120
Trapezoidal tear strength	lb	ASTM D 4533	90,000 ft^2	85
Apparent opening size	Sieve No.	ASTM D 4751	540,000 ft^2	80
Permittivity	sec^{-1}	ASTM D 4491	540,000 ft^2	1.4
Permeability	cm/sec	ASTM D 4491	540,000 ft^2	0.30
Water flow rate	gpm/ft^2	ASTM D 4491	540,000 ft^2	85

Notes:

oz = ounces
yd^2 = square yard
sec^{-1} = second
lb = pound
% = percent
ft^2 = square foot
cm = centimeters
gpm = gallons per minute
sec = second

PART 3 EXECUTION

3.01 TRANSPORT

A. Transportation of the geotextile shall be the responsibility of the SUBCONTRACTOR.

B. During shipment, the geotextile shall be protected from exposure to ultraviolet light, precipitation, mud, dirt, dust, puncture, or other damaging or deleterious conditions.

C. Upon delivery at the job site, the SUBCONTRACTOR shall ensure that the geotextile rolls are handled and stored in accordance with the manufacturer's instructions to prevent damage.

3.02 QUALITY ASSURANCE

A. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC Plan. The SUBCONTRACTOR shall account for these monitoring and testing activities in the construction schedule.

1. The QCSM and SQAM shall examine the geotextile rolls upon delivery to the site and report any deviations from project specifications to the CONTRACTOR.

3.03 INSTALLATION

A. Should the SUBCONTRACTOR damage the geotextile to the extent that it is no longer usable as determined by these Specifications or by the Engineer, the SUBCONTRACTOR shall replace the geotextile at his own cost.

B. The geotextile shall be installed to the lines and grades as shown on the contract Drawings and as described herein.

C. The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self weight. The geotextile shall be securely anchored in an anchor trench where applicable or by other approved or specified methods.

D. In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.

E. The SUBCONTRACTOR shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Should damage to such material occur due to the fault of the SUBCONTRACTOR, the latter shall repair the damaged materials to the satisfaction of the Engineer.

F. During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the Engineer.

G. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct sunlight for more than 15 days after installation.

H. The geotextile shall be covered as soon as possible after installation and approval. Installed geotextile shall not be left exposed for more than 15 days.

I. Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.

*****END OF SECTION*****

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Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02227-0986
EROSION MATTING

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-02227-0986
EROSION MATTING

ATTACHMENTS: Staple Patterns "A" through "E" from North American Green

PART 1 GENERAL

1.01 SUMMARY

A. This Specification section covers the supply and installation of erosion controls for the channels and slopes of the embankments as shown on the Drawings. All activities performed by the SUBCONTRACTOR at any tier shall be in accordance with all applicable Federal, State, and local laws and regulations.

B. General erosion control matting for construction will be dictated by RFETS erosion control procedures.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The most recent version of the reference test methods shall be used in all cases.

1. American Society for Testing and Materials (ASTM)

a. ASTM D 1682 Standard Test Method for Measuring Tensile Strength and Percent Strength Retention of Material after 1000 hours of Exposure in Xenon-Arc Weatherometer

b. ASTM D 4355 Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)

c. ASTM D 5035 Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)

d. ASTM D 5199 Standard Test Method for Measuring Thickness of Textile Materials

e. ASTM D 5261 Standard Test Method for Mass Per Unit Area of Geotextiles

1.03 GENERAL

A. The SUBCONTRACTOR shall implement the storm water pollution prevention measures specified in this section and in Section 02228 EROSION CONTROL in a manner which will ensure that soils are retained on-site.

1.04 SUBMITTALS

A. The SUBCONTRACTOR will prepare the following submittals for review by the CONTRACTOR, the QCSM, and the CQAE in accordance with Section 01305 SUBMITTAL PROCEDURES:

1. Manufacturing, Sampling, and Testing

a. Prior to scheduled use, erosion mat manufacturer's quality control manual, including instructions for storage, handling, installation, seaming, and repair.

2. Erosion Mat

a. Manufacturer's Certificate of Compliance stating that the erosion mat meets the requirements of this section. This submittal shall include copies of manufacturer's quality control test results. The Certificate of Compliance shall be attested to by a person having legal authority to bind the erosion mat manufacturing company.

1.05 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

A. The SUBCONTRACTOR shall abide by all qualification and submittal requirements of the QA/QC Plan and the Work Control Document(s) (WCD).

B. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC plan.

PART 2 PRODUCTS

2.01 SYNTHETIC EROSION CONTROL MATERIALS

A. The synthetic erosion control shall be North American Green (NAG) C125 or equivalent. The coconut fiber shall be evenly distributed over the entire area of the mat. The blanket shall be covered on the top and bottom with heavyweight polypropylene netting having ultraviolet additives to delay breakdown and an approximate 0.625 x 0.625 inch (1.59 x 1.59 centimeter [cm]) mesh size. Table A contains further physical properties of the C125 erosion control blanket.

Table A

Material Content	
Coconut Fiber	100% (0.50 lb./yd^2)
Netting	Both sides, heavyweight UV-stabilized (3 lb/1,000 ft^2 approximate weight)
Thread	100% black polypropylene
Physical Specifications (Roll)	
Width	6.67 feet
Length	108 feet
Weight	40 pounds +/- 10 percent
Area	80 yd^2
Stitch spacing	1.5 inches

B. Permanent erosion control material shall be NAG C350 and/or P550 or equivalent at locations as shown on the Drawings.

The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between a super-heavy-duty UV-stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, an ultra-heavy-duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The corrugated netting shall form prominent, closely spaced ridges across the entire width of the mat.

All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

PART 3 EXECUTION

3.01 INSTALLATION OF SYNTHETIC EROSION CONTROL MATERIAL IN CHANNELS

A. Placement

1. Begin 10 feet back from the top of the channel by anchoring the blanket in a 6-inch deep by 6-inch wide trench. Staple into trench and backfill per manufacturer's recommendations.

2. Roll center blanket in direction of water flow on bottom of channel.

3. Place blankets end over end (shingle style) with a 6-inch overlap. Use a double row of staggered staples 4 inches apart (or an alternative method approved through the RFI process) to secure blankets.

4. Full-length edge blankets at top of side slopes must be anchored in 6-inch-deep by 6-inch-wide trenches. Staple into trench and backfill per manufacturer's recommendations.

5. Blankets on side slopes must be overlapped 4 inches (2 inches for NAG C350 matting) over the center blanket and stapled.

C4

6. Staple the entire length over the width of the channel. Staple pattern "E" will be used for both east and west channels. All erosion blankets shall receive staples as shown on the Drawings. See Section 3.04 for staple patterns.

7. The terminal end of the blankets must be anchored in a 6-inch-deep by 6-inch-wide trench. Staple into trench and backfill per manufacturer's recommendations.

3.02 INSTALLATION OF SYNTHETIC EROSION CONTROL MATERIAL ON SLOPES

A. Placement

1. Place erosion mat (C125, C350, P550, or equivalents) in the areas shown on the Design Drawings.

2. Begin 10 feet back from the top of the slope by anchoring the blanket in a 6-inch-deep by 6-inch-wide trench.

3. Staple into trench and backfill per manufacturer's recommendations.

4 Roll the blankets down or horizontally across the slope.

5. The edges of parallel blankets must be stapled with approximately 5-inch overlap.

6. When blankets must be spliced down the slope, place blankets end over end (shingle style) with approximately 4-inch overlap. Water should flow from upslope mat onto downslope mat without flowing under. Staple through overlapped area, approximately 12 inches apart.

7. Staple the entire length over the width of the slope. Use the recommended staple pattern from paragraph 3.03 based on application, slope, and slope length (or an alternative method approved through the RFI process).

3.03 STAPLE PATTERNS

A. General

1. Table B lists staple patterns shall be used for erosion control materials placed on slopes.

Table B

Slope Length	Slope			
(feet)	4:1	3:1	2:1	1:1
300	B	C	C	C
275	B	C	C	C
250	B	C	C	C
225	B	B	C	C
200	B	B	C	C
175	B	B	C	C
150	A	B	C	C
125	A	A	C	C
100	A	A	C	C
75	A	A	B	C
50	A	A	B	B
25	A	A	B	B

a. Staple Pattern "A"

0.7 staples per square yard using 6-inch, 11-gauge wire "U" staples. 8-inch staples and longer may be used for loose soils. 9-gauge wire staples or heavier may be necessary in hard or rocky soils. Staples shall be placed along the long edge at 6.0-foot intervals and staggered along the shorter edge at 6.5-foot intervals. See the Staple Pattern Template at the end of this Specification.

b. Staple Pattern "B"

1.15 staples per square yard using 6-inch, 11-gauge wire "U" staples. 8-inch staples and longer may be used for loose soils. 9-gauge wire staples or heavier may be necessary in hard or rocky soils. Staples shall be placed along the long edge at 6-foot intervals and staggered along the shorter edge at 3-foot intervals and 1.5-foot intervals from the edge. See the Staple Pattern Template at the end of this Specification.

c. Staple Pattern "C"

1.7 staples per square yard using 6-inch, 11-gauge wire "U" staples. 8-inch staples and longer may be used for loose soils. 9-gauge wire staples or heavier may be necessary in hard or rocky soils. Staples shall be placed along the long edge at 4-foot intervals and staggered along the shorter edge at 2-foot intervals and 1.5-foot intervals from the edge. See the Staple Pattern Template at the end of this Specification.

d. Staple Pattern "D"

3.4 staples per square yard using 6-inch, 11-gauge wire "U" staples. 8-inch staples and longer may be used for loose soils. 9-gauge wire staples or heavier may be necessary in hard or rocky soils. Staples shall be placed along the long edge at 2-foot intervals and along the shorter edge at 20-inch intervals. See the Staple Pattern Template at the end of this Specification.

e. Staple Pattern "E"

3.75 staples per square yard using 6-inch, 11-gauge wire "U" staples. 8-inch staples and longer may be used for loose soils. 9-gauge wire staples or heavier may be necessary in hard or rocky soils. Staples shall be placed along the long edge at 2-foot intervals. Short edge rows shall alternate between 20-inch intervals starting at the edge and 20-inch intervals starting from an additional staple placed 10 inches from the edge. See the Staple Pattern Template at the end of this Specification.

3.04 MAINTENANCE

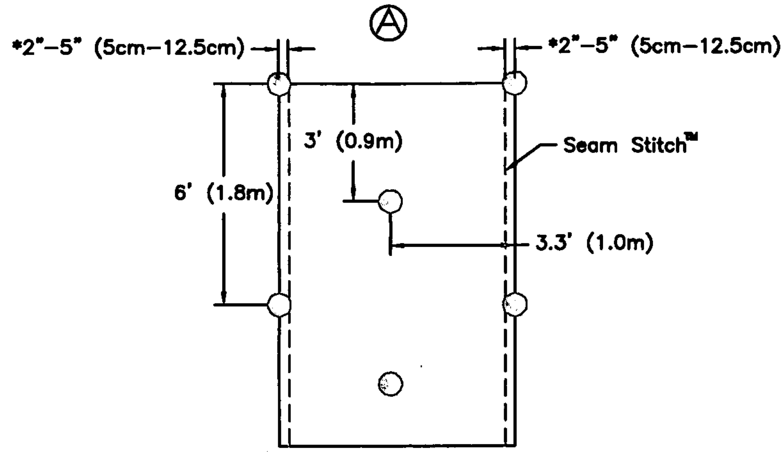
A. The SUBCONTRACTOR shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures as per RFETS erosion control procedures.

*****END OF SECTION*****

ATTACHMENT

STAPLE PATTERNS "A" THROUGH "E" FROM NORTH AMERICAN GREEN

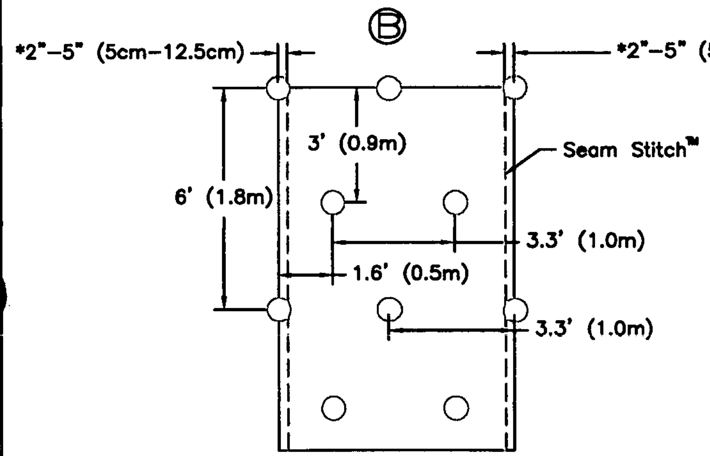
STAPLE PATTERN GUIDE



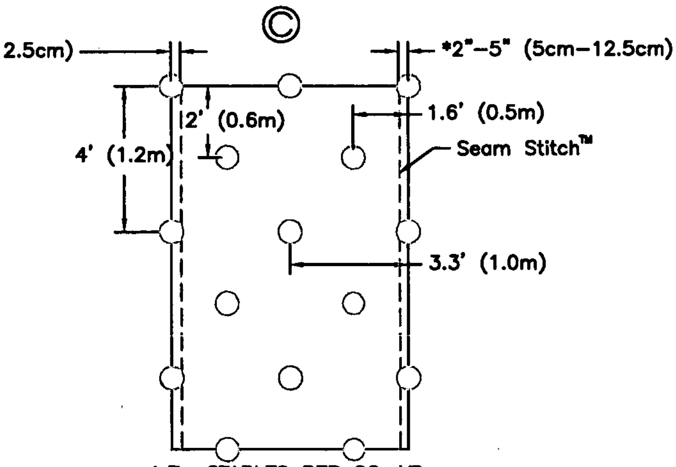
0.7 STAPLES PER SQ. YD.
(0.8 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System™ place staples/stakes through each of the BLUE colored dots.

NORTH AMERICAN GREEN

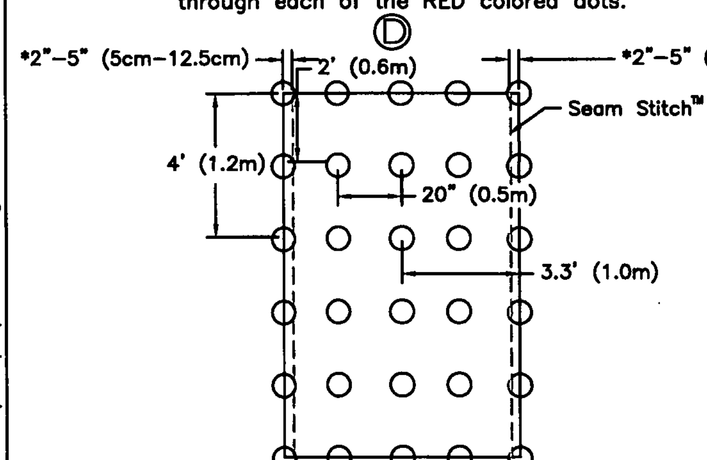
14649 HIGHWAY 41 NORTH
EVANSVILLE, IN 47725
USA 1-800-772-2040
CANADA 1-800-448-2040
www.nagreen.com



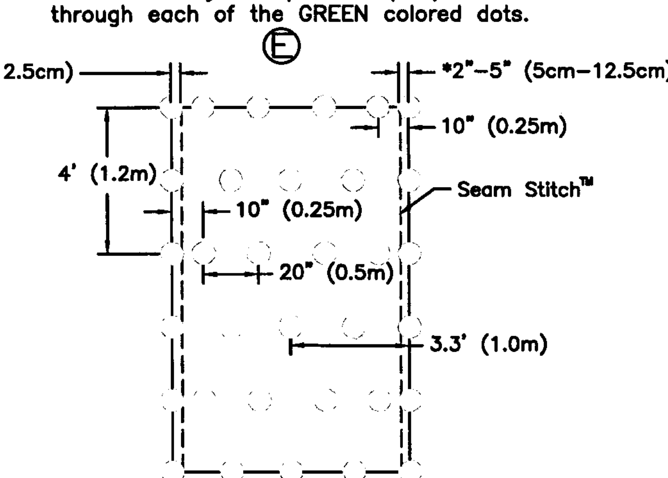
1.15 STAPLES PER SQ. YD.
(1.35 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System™ place staples/stakes through each of the RED colored dots.



1.7 STAPLES PER SQ. YD.
(2.0 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System™ place staples/stakes through each of the GREEN colored dots.



3.4 STAPLES PER SQ. YD.
(4.1 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System™ place staples/stakes through each of the WHITE colored dots.



3.75 STAPLES PER SQ. YD.
(4.5 STAPLES PER SQ. M)
For blankets with the optional North American Green DOT System™ place staples/stakes through each of the YELLOW colored dots.

*Location of Seam Stitch™ will vary depending on North American Green product type:

l/group/c...hawn_Raf/staplepattern.dwg

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Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02228-0987
EROSION CONTROL

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-02228-0987
EROSION CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Specifications for erosion control components and their installation. All activities performed by the SUBCONTRACTOR shall be in accordance with all applicable Federal, State, and local laws and regulations and RFETS erosion control procedures.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The most recent version of the reference test methods shall be used in all cases.

1. American Society for Testing and Materials (ASTM)

   a. ASTM D 3786 Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method

   b. ASTM D 4439 Standard Terminology for Geotextiles

   c. ASTM D 4491 Water Permeability of Geotextiles by Permittivity

   d. ASTM D 4533 Trapezoid Tearing Strength of Geotextiles

   e. ASTM D 4632 Grab Breaking Load and Elongation of Geotextiles

   f. ASTM D 4751 Determining Apparent Opening Size of a Geotextile

   g. ASTM D 4873 Identification, Storage, and Handling of Geotextiles

1.03 GENERAL

A. The SUBCONTRACTOR shall implement the storm water pollution prevention measures specified in this section, and outlined in the Work Control Document(s) in a manner which will ensure that all soils are retained on-site.

1.04 EROSION AND SEDIMENT CONTROLS

A. The controls and measures required by the SUBCONTRACTOR are described below.

1. Stabilization Practices

   The stabilization practices to be implemented shall include geotextiles, erosion control mats, and preservation of mature vegetation.

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2. Structural Practices

Structural practices shall be implemented as per RFETS erosion control procedures to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall, as a minimum, include the following devices, as applicable:

a. Silt Fences

The SUBCONTRACTOR shall maintain existing silt fences and provide additional silt fences as necessary for temporary structural practice to minimize erosion and sediment runoff. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g., clearing and grubbing, excavation, embankment, and grading).

b. Straw Bales and/or Straw Waddles

The SUBCONTRACTOR shall provide bales of straw and/or straw waddles as a temporary structural practice to minimize erosion and sediment runoff. Bales and/or waddles shall be placed to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area.

c. GeoRidge®

The SUBCONTRACTOR shall provide GeoRidges® as a temporary structural practice to minimize erosion and sediment runoff. GeoRidges® shall be placed to effectively retain sediment immediately after completing each diversion berm and side channel phases of work.

PART 2 PRODUCTS

2.01 COMPONENTS FOR SILT FENCES

A. Filter Fabric

1. The geotextile shall comply with the requirements of ASTM D 4439 and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F. Unless otherwise approved by the SQAM or CONTRACTOR, the filter fabric shall meet the following requirements:

Table A
Filter Fabric For Silt Screen Fence

Physical Property	Test Procedure	Strength Requirement
Grab Tensile Elongation (%)	ASTM D 4632 (30% max.)	100 lbs. min.
Trapezoid Tear	ASTM D 4533	55 lbs. min.
Mullen Burst	ASTM D 3786	270 lbs. min.
Permittivity	ASTM D 4491	0.2/sec
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

B. Silt Fence Stakes and Posts

1. The SUBCONTRACTOR may use either wooden stakes or steel posts for fence construction. Wooden stakes utilized for silt fence construction shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 5 feet.

2.02 COMPONENTS FOR STRAW BALES AND/OR WADDLES

A. The straw in the bales and waddles shall be stalks from oats, wheat, rye, barley, or rice, furnished in air-dry condition. The bales shall have a standard cross section of 14 inches by 18 inches. All bales shall be either wire-bound or string-tied. The SUBCONTRACTOR may use either wooden stakes or steel posts to secure the straw bales to the ground. Wooden stakes utilized for this purpose shall have a minimum dimensions of 2 inches x 2 inches in cross section and shall have a minimum length of 3 feet. Steel posts (standard "U" or "T" section) utilized for securing straw bales, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 3 feet.

2.03 COMPONENTS FOR GEORIDGES

A. The GeoRidge® system comprises a series of synthetic, porous berms installed perpendicular to the direction of flow. The GeoRidge® berms are constructed of a UV-stabilized high-density polyethylene. GeoRidge® is designed to increase channel and slope roughness to reduce flow velocity. Where soils are very loose or very firm, use 250 mm galvanized spikes with washers.

PART 3 EXECUTION

3.01 INSTALLATION OF SILT FENCES, STRAW BALES, AND STRAW WADDLES

A. Install as per RFETS erosion control procedures.

3.02 INSTALLATION OF GEORIDGES®

A. GeoRidge® shall be installed on top of the erosion control blanket for a given channel. For multiple GeoRidge® panels in the same row, overlap panels by minimum 50 mm (2 inches). Cut a slot in the crest of the overlapping berm to allow contact between the foot of the berm and the soil.

B. Anchor GeoRidge® with a 10 inch spike. Anchor spacing depends on soil condition and density. Minimum recommendation is 3 anchors on the upstream side and 2 anchors on the downstream side. Install to prevent water from going around or under the GeoRidge®.

C. Subsequent panels shall extend both across the bottom of the ditch and opposite the sideslope, as well as up the original backslope or sideslope at the distance determined by the Engineer.

D. Install as per manufacturer's recommendations if different from above.

3.03 MAINTENANCE

A. Maintain erosion controls as per RFETS erosion control procedures.

3.04 INSPECTIONS

A. General

1. The SUBCONTRACTOR shall inspect disturbed areas of the construction site as per RFETS erosion control procedures.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02245-0988
STONE AND AGGREGATE MATERIALS

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-02245-0988
STONE AND AGGREGATE MATERIALS

PART 1 GENERAL

1.01 SUMMARY

A. This specification section covers the supply, installation, and testing of stone protection materials for the central channel as shown on the Drawings. All activities performed by the SUBCONTRACTOR or any subcontractor at any tier shall be in accordance with all applicable Federal, State, and local laws and regulations.

1.02 REFERENCES

A. The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only. The most recent version of the referenced Test Methods shall be used in all cases.

1. American Society for Testing and Materials (ASTM)

   a. ASTM C 88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

   b. ASTM C 127 Specific Gravity and Absorption of Coarse Aggregates

   c. ASTM C 131 Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

   d. ASTM D 422 Method for Particle Size Analysis of Soils

1.03 SUBMITTALS

A. The SUBCONTRACTOR will prepare the following submittals for review by the CONTRACTOR in accordance with Section 01305 SUBMITTAL PROCEDURES:

1. Suppliers' Test Results demonstrating compliance with Part 2 and stone geologic source.

1.04 EQUIPMENT

A. All equipment and tools used in the performance of the work will be subject to approval by the CONTRACTOR before the work is started and shall be maintained in satisfactory working condition at all times.

1.05 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

A. The SUBCONTRACTOR shall abide by all qualification and submittal requirements of the QA/QC Plan and the Work Control Document(s) (WCD).

B. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC plan.

PART 2 PRODUCTS

2.01 MATERIALS

A. Riprap

1. Stone used for riprap shall be hard, dense, angular in shape, resistant to weathering, and free from seams, cracks or other structural defects. The stone shall have a specific gravity of at least 2.60. Each piece shall have its greatest dimension not greater than four times its least dimension. The riprap shall be reasonably well-graded from coarse to fine, falling within the limits of the gradation requirements given in Table A.

2. Control of gradation will be by visual inspection and the supplier's gradation submittal as shown in Table A.

Table A
RIPRAP GRADATION REQUIREMENTS

D_{50} stone size[1] (inches)	% of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (inches)	Typical Stone Weight[4] (pounds)
6	70-100	12	85
	50-70	9	35
	35-50	6	10
	2-10	2	0.4
9	70-100	15	160
	50-70	12	85
	35-50	9	35
	2-10	3	1.3
12	70-100	21	440
	50-70	18	275
	35-50	12	80
	2-10	4	3

Notes:
[1]D_{50} = Nominal stone size
[2]Based on typical rock weight
[3]Equivalent spherical diameter
[4]Based on specific gravity=2.60

B. Boulders

1. Boulders shall be hard, dense, angular in shape, resistant to weathering, and free from seams, cracks or other structural defects. The stone shall have a specific gravity of at least 2.60. Boulders shall be at least 24-inches in one dimension so that when buried 6-inches, 18-inches are exposed.

PART 3 EXECUTION

3.01 PREPARATION

A. Areas on which separation geotextile, bedding material, riprap, or boulders are to be placed shall be graded and dressed to lines and grades shown on the drawings and in accordance with Section 02110 SITE PREPARATION. Eroded or washed-out areas shall be repaired prior to placement of material.

3.02 STONE

A. General

Riprap and boulders shall be placed within the limits shown on the drawings.

B. Placement

1. Riprap stone shall be placed in such manner as to produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids. Riprap shall be placed to its full course thickness in one operation. The larger stones shall be well distributed and the entire mass of stones in their final position shall be roughly graded to conform to the gradation specified. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source and by controlled dumping of successive loads during final placing and placement. Zero drop height placement procedures are to be utilized for riprap stone. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to obtain a reasonably well-graded distribution of stone sizes as specified above. Riprap shall be placed from down slope to up slope to form a continuous buttress of rock as placement progresses.

2. Boulders shall be spaced per the design drawings. Placement will begin with the excavation of a 6-inch deep hole wide enough to bury the bottom 6-inches of the boulder. Erosion mat per the design drawings will be placed over the hole followed by placement of the boulder. The erosion mat shall be scored or cut in the area over the hole prior to boulder placement to limit tension of the erosion mat. The boulder will be placed so that 6-inches are buried and a minimum of 18-inches is above grade within the channel bottom. Alternatives methods may be used by the SUBCONTRACTOR so long as erosion mat or other separation layer such as geotextile is located under the boulder.

3.04 GROUTING

A. Where shown on the Drawings, fill spaces between stones with cement mortar. Use sufficient amount of mortar to fill voids and leave face surface of stone exposed. Place grout from bottom to top and sweep surface with stiff broom. After grouting is completed, wet-cure surface.

3.05 PROTECTION

A. The SUBCONTRACTOR shall maintain the riprap stone and boulders until accepted and any material displaced by any cause shall be replaced.

*****END OF SECTION*****

Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02900-0990
SEEDING

APPROVED

APPROVED AS CORRECTED

NOT APPROVED

REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

SPEC-02900-0990
SEEDING

PART 1 GENERAL

1.01 SUMMARY

A. The vegetation requirements for seeding shall be as described in the plans referenced below. All activities performed by the SUBCONTRACTOR shall be in accordance with all applicable Federal, State, and local laws and regulations.

1.02 REFERENCES

A. The following publications listed below form a part of the Specification to the extent referenced. The publications are referenced in the text by basic designation only. The most recent version of the referenced test methods shall be used in all cases.

1. American Society for Testing and Materials

   a. ASTM D 2974 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

2. U.S. Department of Agriculture Federal Seed Act of 9 August 1939 (55 Stat. 1275)

3. The RFETS Revegetation Plan (Jan 2004, Rev 2)

1.03 SUBMITTALS

A. The SUBCONTRACTOR will prepare the following submittals for review by the CONTRACTOR and the QCSM in accordance with Section 01305 SUBMITTAL PROCEDURES:

1. Manufacturer's Catalog Data:

   Manufacturer's standard catalog data giving the brand names and catalog numbers of erosion control materials, in sufficient detail to demonstrate complete compliance with this section.

2. Manufacturer's Instructions:

   The manufacturer's installation instructions and procedures.

3. Approval of Materials:

   Material sources and material test results prior to field use.

4. Certified copy of seed analysis.

5. Seed bag tickets.

1.04 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

A. The SUBCONTRACTOR shall abide by all qualification and submittal requirements of the QA/QC Plan and the Work Control Document(s) (WCD).

B. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC Plan.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery

Material used for seeding, such as seed, fertilizer, hay, hay bales, blankets, etc., shall be inspected upon arrival at the job site.

B. Storage

Seed shall be protected from any drying, moisture or contamination by detrimental material upon delivery and when being stored.

PART 2 PRODUCTS

2.01 SEED

A. The pure live seed (PLS) mixture to be used shall be as follows:

1. Seed Mixture:

a. The seed is to be ordered as PLS.

b. The seed must be certified weed-free.

c. Seed is to be ordered and bagged separately by species (i.e., the seed company should deliver all the seed in separate bags by species). This allows Site ecologists to examine the seed for purity prior to seeding.

d. Seed bag tags will be pulled off the bags and provided to the CONTRACTOR.

B. See Attachment for additional information.

2.02 NUTRIENT AMENDED SOIL/TOPSOIL

A. As per the RFETS Revegetation Plan (January 2004 revision 2) RFETS Revegetation Plan.

B. See Attachment for additional information.

2.03 SOIL EROSION CONTROL MATERIAL AND STAPLES

A. Erosion control materials shall conform to Section 02228 EROSION CONTROL

1. Synthetic Erosion Control Materials

2. Silt Control Fence

3. Straw Bales

PART 3 EXECUTION

3.01 SEEDING

A. Seeding will take place per the current RFETS Revegetation Plan. Seeding of the channels, diversion berms, and buttress sideslope where vegetation is required for permanent erosion control will be seeded with the following additional steps:

1) The area will be ripped.

2) A minimum of 2-inches of bottom alluvium (excavated from buttress area) will be placed on the surface.

3) A DGR LGP dozer (track pressure of 4.97 psi) will be used to grade and construct the berms and channels to minimize over-compaction.

4) Seed will be hand broadcast due to safety issues of using equipment on berms.

5) Erosion mat will be placed per manufacturer's recommendations.

6) No vehicles or equipment will be allowed on the berms or in the channels without specific authorization from the RM.

B. See Attachment for additional information.

*****END OF SECTION*****

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ATTACHMENT

REVEGETATION SPECIFICATION SHEET

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Red Map Areas

Hillside Slope Areas (Hillside Areas Or Areas With Slopes Greater Than 10%) Revegetation Specification Sheet

This Revegetation Specification Sheet Supercedes All Previous Revegetation Information For RFETS
Date: 1/04

Seedbed Preparation:

1. No imported topsoil will be used.
2. Soil surface is to be ripped or scarified to a depth of 2 – 3 feet to relieve soil compaction, as needed.
3. Soil surface is to be disced to reduce soil particle size and get rid of larger clods, as needed.

Seed Mix:

1. Purchase attached seed mixture for the total number of acres to be reseeded. The values in the far right hand column are the amounts per acre to be used when drill seeding. Be sure to order the correct variety of seed. NOTE: For broadcast seeding, double the amounts shown in the far right hand column.
2. The seed is to be ordered as pure live seed (PLS).
3. The seed must be certified weed free.
4. Seed is to be ordered and bagged separately by species (i.e. the seed company should deliver all the seed in separate bags by species). This allows Site ecologists to examine the seed for purity prior to seeding.
5. Pull the seed bag tags off the bags and provide them to the K-H Ecology Group.

Seed Application:

1. Although no seeding windows are specified, greater success may be achieved when seeding is done in late fall, winter, or early spring.
2. The seed can be drill seeded or broadcast seeded over the disturbed areas. Make sure to use the correct amount of seed for the application method chosen.
3. For broadcast seeding, handseeding or mechanical seeders such as a centrifugal, fan, airblast, or hydroseeder are to be used to distribute the seed. After broadcasting, the area is to be drag-chained or raked to cover the seed slightly and provide better seed/soil contact. Broadcasting may be more appropriate on the steeper slopes for safety concerns.
4. Drill seeding is best used on the flat or shallow slope areas. For drill seeding, the seeding depth is to be between 0.25 inches and 0.5 inches. Because the Site is prone to high winds, drill seeding is to be done using two passes, with the applications being perpendicular to each other and 45 degrees offset from the predominant wind direction. Seeding should not be done when wind speeds are greater than 20 mph.
5. Seeding will be done prior to any mulch applications.

Soil Amendments:

No soil amendments will be added without approval of K-H Ecology Group.

Mulch Application:

The following guidelines should be used to determine the type of erosion control measures needed for revegetation applications.

Erosion Control Type	Percent Slope
Crimped Straw*	0 – 10%
Hydromulch*	0 – 15%
Erosion matting	>15%

*For larger areas, crimped straw is more appropriate and less expensive, whereas for smaller areas hydromulch may be more applicable because of equipment constraints.

For application of crimped straw and hydromulch follow the guidelines listed below. For application of erosion control matting, follow the manufacturers recommendations. Seed will be planted prior to application of erosion control mats.

Crimped Straw

1. Straw mulch is to be spread evenly across the revegetated area after seeding (drilled or broadcast) has been completed. It is to be applied at a rate of 1.5 tons per acre. NOTE: The straw must be certified as weed and pest free according to the Colorado Weed Free Forage Act. It should be either winter wheat or oats and not have an abundance of seed heads present in the straw.
2. The straw is to then be crimped into the soil to prevent it from blowing away. If crimping is not feasible, then after the straw has been blown onto the seeded surface it is to be covered with a chemical tackifier

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Hillside Slope Areas (Hillside Areas Or Areas With Slopes Greater Than 10%) Revegetation Seed Mix
(Based on 50 seeds/sq.ft.)

Red Map Areas

This Revegetation Specification Sheet Supercedes All Previous Revegetation Information For RFETS
Date: 1/04

Species	Common Name	Variety	% of Seed Mix	# Seeds Needed	# Seeds/Lb.	# Seeds/Sq. Ft.
Graminoids.						
Agropyron dasystachyum	Thickspike Wheatgrass	Critana	5	108900	150000	2.5
Agropyron smithii	Western Wheatgrass	Arriba	23	500940	120000	11.5
Agropyron trachycaulum	Slender Wheatgrass	San Luis	15	326700	120000	7.5
Bouteloua curtipendula	Side-Oats Grama	Vaughn	13	283140	190000	6.5
Bouteloua gracilis	Blue Grama	Hachita	24	522720	710000	12.0
Buchloe dactyloides	Buffalo Grass	Texoka	10	217800	45000	5.0
Stipa viridula	Green Needle Grass	Lodorm	10	217800	180000	5.0
	Total		100	2178000		50.0

Sq. ft/acre	43560
Seeds/sq. ft.	50
Seeds needed/acre	2178000

1) This pounds per acre assumes drill-seeding is used. If the seed is to be broadcast, the application rates are to be doubled.

2) PLS = pure live seed. Be sure to specify this to the seed dealer when ordering.

3) The seed is to be certified weed free.

4) Seed is to be ordered and bagged separately by species (i.e. the seed company should deliver all the seed in separate bags by species). This allows Site ecologists to examine the seed for purity prior to seeding.

NOTE:
Slender wheatgrass and thickspike wheatgrass have been added to species mix as early successional species.

For questions regarding this spec sheet or if variances from these specifications are required contact the K-H Ecology Group at x2231, x3560, or x3887.

following the manufacturers recommended application rate. Tackifying agents found to be "environmentally friendly" and chemically acceptable for use at the Site are those comprised of plant gums or organic co-polymers. Tackifier is to be applied at the manufacturer recommended rate per acre.

Hydromulch

1. Acceptable hydromulches include inert wood and plant fiber products (cellulose). Only tackifiers based on vegetable-based binders are acceptable at the Site to prevent undesired chemicals from leaching into the groundwater. Tackifying agents found to be "environmentally friendly" and chemically acceptable for use at the Site are those comprised of plant gums or organic co-polymers. The product known by the brand name "SoilGuard®" was also found to be chemically acceptable.
2. Hydromulch and tackifier are to be applied at the manufacturer recommended rates per acre.
3. Application of seed within hydromulch is not an accepted practice at the Site. Therefore areas are to be seeded (drilled or broadcast) prior to the hydromulch application. The hydromulch is to be applied with a tackifying agent to help prevent further erosion.

For questions or more information regarding this spec sheet or if variances from these specifications are required contact the K-H Ecology Group at x2231, x3560, or x3687.

APPENDIX B

CONSTRUCTION QA/QC PLAN (FINAL 100%)

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KAISER HILL COMPANY

ACCELERATED ACTION DESIGN FOR THE ORIGINAL LANDFILL ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

FINAL CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN

Project No. 57378.6040
May 2005

COLORADO REGISTERED
RANDALL C. THOMPSON
5/12/05
30638
PROFESSIONAL ENGINEER

EarthTech
A Tyco International Ltd. Company

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ACCELERATED ACTION DESIGN FOR THE ORIGINAL LANDFILL ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

FINAL
CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN

Prepared for:
Kaiser-Hill Company, L.L.C.
Golden, Colorado

Prepared by:
Earth Tech, Inc.
Englewood, Colorado

Project No. 57378.6030

May 2005

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LIST OF ACRONYMS AND ABBREVIATIONS

CDPHE	Colorado Department of Public Health and Environment
Contractor	Kaiser-Hill Company, L.L.C.
CQA	construction quality assurance
CQAE	Construction Quality Assurance Engineer
CSM	Construction Site Manager
DM	Design Manager
DOE	Department of Energy
Earth Tech	Earth Tech, Inc.
ECR	Engineering Change Request
EPA	Environmental Protection Agency
ER	Engineer's Representative
Kaiser-Hill	Kaiser-Hill Company L.L.C.
OLF	Original Landfill
OLF Cover	soil cover and buttress fill at the OLF
QA	quality assurance
QC	quality control
QCSM	Quality Control Site Manager
RFETS	Rocky Flats Environmental Technology Site
RFI	Request for Information/Clarification
RM	Responsible Manager
SQAM	Site Quality Assurance Manager
Subcontractor	construction subcontractor

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1.0 PROJECT DESCRIPTION

The Original Landfill (OLF) is a 20-acre area where construction debris and general facility waste were placed from 1950 to 1968. The OLF is located on the south-facing slope just south of the Industrial Area pediment and borders on the northern side of Woman Creek. Accurate and verifiable records of the wastes placed in the landfill are not available. There is no information indicating that the OLF was used for routine disposal of radioactive material or other hazardous substance waste streams.

The primary objective of the project is to reconfigure the landfill to improve stability, cover the waste with a minimum of 2 feet of soil, and provide surface water control. To achieve this objective, the project will include the following construction activities: regrade the existing slopes; add fill soil to achieve a consistent grade; cover the waste area with 2 feet of loose, un-compacted soil; and construct a soil buttress at the toe of the landfill. Surface water controls will include diversion berms and perimeter channels. Erosion control will include seeding and erosion mats.

This Construction Quality Assurance (QA)/Quality Control (QC) Plan has been developed to reflect the level of complexity of the project.

2.0 PURPOSE AND SCOPE

QA/QC for construction of the soil cover and buttress fill at the OLF (OLF Cover) will be conducted in accordance with this Construction QA/QC Plan. This Construction QA/QC Plan has been prepared for the Contractor (Kaiser-Hill Company, L.L.C. [Kaiser-Hill]) in conjunction with the design of the OLF Cover and will be implemented in its entirety to ensure the following:

- All Rocky Flats Environmental Technology Site (RFETS) project activities are performed in a manner consistent with the intent of all approved Design Drawings and Specifications.
- All performance criteria are achieved.
- The specified quality of work is maintained.

This Construction QA/QC Plan is a site-specific document that addresses the organization, authority, responsibilities, specific QA/QC requirements of project-specific tasks, and QA/QC documentation and submittals. This document includes considerations specific to the requirements of the construction of the OLF Cover.

DEFINITIONS OF QUALITY CONTROL AND QUALITY ASSURANCE

Quality Control is the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that the process, item, or standard meets the established requirements.

Quality Assurance is the system that provides oversight and evaluation of the QC process and overall quality goals to ensure that QC is working effectively and that the project goals are being met.

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3.0 QUALITY ASSURANCE/QUALITY CONTROL ORGANIZATION

3.1 PROJECT ORGANIZATION

It is anticipated that the following personnel will serve in specific QA/QC roles for the construction of the OLF Cover:

1. Mike Keating (Kaiser-Hill), Responsible Manager (RM) and Site Engineer
2. Randy Thompson (Earth Tech, Inc. [Earth Tech]), Design Manager (DM)
3. Steve McQueary (Envirocon), Construction Site Manager (CSM)
4. TBD, Construction Quality Assurance (CQA) Engineer (CQAE)
5. TBD, Site QA Managers (SQAMs)
6. To be determined (Golder), Quality Control Site Manager (QCSM)
7. Golder, Quality Control Testing Subcontractor
8. Ryan Archibald and Scott Powell (Earth Tech), Engineer's Representatives (ERs)

3.2 ROLES AND RESPONSIBILITIES

The Kaiser-Hill **Responsible Manager** has responsibility for coordination of work performed at RFETS by the construction subcontractor (Subcontractor). He has overall responsibility for verifying that all project participants safely and properly implement their duties as related to the construction of the OLF Cover. Changes to the project scope or the approach to the implementation of the design brought on by differing site conditions or refinements to the task approach will be approved through the Kaiser-Hill RM. The Kaiser-Hill RM will be assisted by the DM and in the field by the ER.

The **Design Manager** will be responsible for providing the Contractor with a complete design package that includes design drawings, specifications, calculations, and a Construction QA/QC Plan. The design package will be stamped by a Professional Engineer registered in the State of Colorado. The DM will also be responsible for reviewing and approving all Requests for Information/Clarification (RFIs), submittals, and change orders.

The **Construction Site Manager** will be responsible for managing all construction activities, equipment, construction quality, safety, staffing, and daily briefings.

The **Construction Quality Assurance Engineer** will be responsible for certifying that the construction has been completed in accordance with the Environmental Protection Agency

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(EPA)/Colorado Public Health and Environment (CDPHE)-approved plans, Design Drawings, Specifications, and changes. The CQAE will be a Professional Engineer registered in the State of Colorado who has provided engineering oversight for similar projects. The CQAE represents the organization responsible for QA; therefore, reference to the CQAE also refers to his/her company or designee. The designee for the OLF Cover installation will be the CQAE; any reference to the SQAM in this Construction QA Plan also refers to the CQAE. The CQAE is responsible for the implementation of and compliance with the CQA program for the construction scope of work. The CQAE will be on-site when appropriate. It is also the CQAE's responsibility to approve submittals and submit them to the Design RM for final approval. QA personnel are responsible for monitoring QC activities to ensure that the work complies with the contract requirements.

The **Site Quality Assurance Manager** is responsible for on-site project QA on a daily basis and for communication with the Design Team (Kaiser-Hill/Earth Tech). This mainly entails the responsibility to monitor, oversee, and direct the daily QA activity. The SQAM will complete a Daily QA Report and review the Daily QC Report. The SQAM will be present full-time for the duration of the project. The SQAM will support the CQAE in implementing the QA program. QA personnel are responsible for monitoring QC activities to ensure that the work complies with the contract requirements. The SQAM will verify decisions to excavate unsuitable material in the buttress excavation.

The **Quality Control Site Manager** will be on-site during all work activities related to the design and verify that day-to-day tasks are performed according to the approved project specifications and procedures and will report directly to the RM, CSM and the CQAE. The QCSM will be on-site full-time for the duration of the project. The QCSM shall have provided QA or QC oversight for similar projects. The QCSM's daily activities will include accumulation of data for and preparation of the Daily QC Report, material testing, and coordination and control of project-specific quality records. The QCSM will also implement QC and take the lead role in promoting and enforcing QC for all project subcontractors as well as coordinating all project inspections in accordance with criteria established by the overall construction team. The QC process will be the complete responsibility of the Contractor and its Subcontractor.

The **Engineer's Representatives** will be available to the project to clarify and resolve design issues as they arise during construction activities. It is important to have timely resolution of every issue to eliminate delays.

The **Site Engineer** will be responsible for evaluating field engineering issues, developing proposed design changes, and making engineering decisions as per specifications and QA/QC Plan. The Site Engineer will be supported by geologist and geotechnical engineer as needed.

The **CDPHE Project Representative** will be responsible for evaluating and approving all project changes. The CDPHE Project Representative should be on-site during all construction activities.

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4.0 PROJECT MEETINGS

Periodic meetings will be held throughout the construction project. These meetings are intended to maintain communication among the Contractor, Subcontractor, Design Engineer, CQAE, QCSM, Department of Energy (DOE), EPA, CDPHE, and their representatives. These meetings will help maintain familiarity with construction procedures and activities, quality issues, health and safety issues, and field changes, if any.

The schedule, agenda, and attendees of these meetings are discussed in the following subsections.

4.1 PRE-CONSTRUCTION MEETING

A pre-construction meeting shall be held before the start of construction activities. At a minimum, the meeting will be attended by the DOE, the QCSM, who is in charge of QC activities; the CQAE, who is charge of QA activities; the Kaiser-Hill Construction Manager; the CSM; the DM; and representatives from the CDPHE and EPA. The meeting shall include the following:

- Review the project history, design and project organization;
- Discuss project safety, personal protective equipment, monitoring, hazards, heavy equipment, trucking, etc.;
- Discuss the Radiological Work Permit, including personal protective equipment, surveys, and controls;
- Discuss the CQA and construction QC documents, procedures, and communications;
- Project Schedule;
- Regulator oversight;
- Establish procedures by which the Subcontractor assists the QA/QC staff in obtaining samples; and
- Review the protocol(s) for handling construction deficiencies, repairs, and retesting outlined in the following section.

4.2 DAILY PRE-EVOLUTION MEETING

The construction project personnel will meet every day prior to starting work to discuss work assignments, safety, construction activities, work approaches, and QC issues. Attendees will sign the roster for the meeting.

4.3 WEEKLY PROGRESS MEETINGS

Weekly progress meetings will be held with the KH Management Team, QA/QC Staff, DOE, EPA, and CDPHE to:

- Review and discuss the previous week's activities and progress,
- Discuss current and future work,
- Discuss any current or potential construction problems,
- Discuss outstanding action items and their resolutions, and
- Discuss new action items.

The Kaiser-Hill RM will schedule and conduct the weekly progress meetings and will transmit the meeting minutes to all parties attending the meeting. Other individuals may be requested to attend the weekly meetings depending upon recent or future work activities. The SQAM will attend the meetings and designated representatives from the CDPHE and EPA shall be invited by the Kaiser-Hill RM to attend all weekly meetings so that they may discuss and evaluate progress.

4.4 WEEKLY CONSTRUCTION MEETINGS

Weekly construction meetings conducted by the CSM and attended by construction staff will be held to:

- Review and discuss the previous week's construction activities and progress,
- Discuss current and future construction work,
- Discuss any current or potential construction problems,
- Discuss outstanding action items and their resolutions, and
- Discuss new action items.

These meetings are intended to discuss detailed construction issues with the construction management team. The SQAM will attend these meetings or assign a representative to attend in his/her absence.

4.5 PROBLEM OR WORK DEFICIENCY MEETINGS

Special meetings may be held when a problem or deficiency occurs or is identified. Special work deficiency meetings will be attended by the RM, QCSM, Design Manager, CQAE, SQAM, relevant subcontractors, and/or other involved parties, as necessary. The purpose of these meetings is to identify problems or deficiencies in the construction work, review alternative solutions, and select and implement corrective measures to resolve the problems or deficiencies.

4.6 MANAGER'S MEETING

Construction safety occurrences will be evaluated by a team of RISS Managers, DOE Safety Representatives, KH Safety, and the project team. Safety occurrences will be evaluated to determine the root cause and corrective measures will be implemented to minimize the likelihood of re-occurrence.

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5.0 COMMUNICATION

5.1 CHANGED CONDITIONS/CHANGE NOTICES

A key element of the design and construction process is addressing changes in project scope, changes in site conditions, and design changes to improve the quality of the finished product. These project changes will be managed by the RFI or Engineering Change Request (ECR) process. The objective of the project is to reconfigure the existing landfill into a more stable configuration with a minimum of 2 feet of soil cover.

5.1.1 Field Changes

Field changes include minor alignment adjustments to the limits of the landfill due to field conditions. This may include limits of the cover soil, limits of regarding, diversion berm alignment, and perimeter channel alignments.

The changes will be approved by the RM and documented in the field logs of the foreman or superintendent. The adjustments will be surveyed during final topography survey and as-built preparation.

5.1.2 Request for Information

The Contractor/Subcontractor will describe the issue and potential solutions on the RFI or ECR form and forward it to the DM, the Engineer of Record or designee for review. The DM or designee will concur with the change or recommend an alternative change. All RFIs will be tracked. A copy of the approved RFI form will be forwarded to the CQAE. Minor design changes will be documented and approved by the Kaiser-Hill Construction Manager/RM.

5.1.3 Engineering Change Request

The Contractor/Subcontractor will describe the issue and recommended an engineering change on the ECR form and forward it to the DM, the Engineer of Record or designee for review. The DM or designee will concur with the engineering change or recommend an alternative change. All ECRs will be tracked. A copy of the approved ECR form (and drawings) will be forwarded

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to the CQAE. Minor design modifications will be documented and approved by the Kaiser-Hill RM.

5.2 DAILY REPORTS TO RISS

The RM meets daily with the RISS vice president to discuss schedule, project issues, budget, safety, and productivity.

5.3 WEEKLY STATUS REPORTS

The RM will generate a weekly e-mail to update DOE, EPA, CDPHE, project team, and RISS management on activities completed in the previous week and activities proposed for the coming week.

6.0 DOCUMENTATION

6.1 QA/QC DOCUMENTATION

Final acceptance of the OLF Cover will be achieved through adequate documentation of the construction and QA/QC activities. Attachment 1 provides sample project forms to be used throughout construction of the OLF Cover and lists the party responsible for the completion of each form. Final approval of all project forms will come from the CQAE and the Kaiser-Hill RM or their designee(s). All project forms may be modified to suit construction activities as long as the modifications are approved by the CQAE and the Kaiser-Hill RM. The project forms are:

- Daily Quality Control Report
- Daily Quality Assurance Report
- Field Nuclear Density Test Log
- Material Delivery/Inventory Checklist
- Submittal Register
- Transmittal Form
- Request for Information Form
- Engineering Change Request Form

Project forms are not limited to this list and may be added as needed during construction or as required by the CQAE. Completed forms will be included in the Construction Completion Report described in Section 8.3.

6.2 DOCUMENTATION PROCEDURES

All project forms will be completed in blue or black ink in a legible manner. Errors made in any handwritten form will be crossed out with a single line and the correct information entered. The change will be initialed and dated by the individual making the correction.

When a project form has been completed, it will be submitted to the SQAM for review and approval. After approval by the SQAM, the forms will be submitted to the Kaiser-Hill RM.

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6.3 RECORD KEEPING

Original project records will be maintained on-site by the Subcontractor. Copies of project records generated on the site during construction will be placed in a file cabinet under the control of the QCSM and SQAM. Examples of on-site project records include daily reports, testing logs, and load tickets. Following construction, relevant file copies of all site records will be kept by the Subcontractor, the CQAE, and the Contractor.

6.4 NONCONFORMING CONDITIONS

Nonconforming conditions will first be noted in the QCSM's or SQAM's daily report. The reports will have action item checklists that will be carried over to following reports until the nonconformance is remedied. If the issue cannot be addressed by the QCSM or the SQAM, the nonconforming conditions may be handled through the RFI process. In any case, discussion of nonconforming conditions will take place during weekly construction meetings.

7.0 QUALITY ASSURANCE/QUALITY CONTROL PROCESS

7.1 CONSTRUCTION QUALITY CONTROL

The QC program will ensure that the construction of the OLF Cover is conducted in accordance with the Design Drawings and Specifications approved by CDPHE. The QCSM will be responsible for implementing the QC requirements set forth in the Design Drawings and Specifications. QC activities are outlined in the Specifications and summarized in Table 7.1.

All QC deficiencies will be reported to the SQAM for resolution. The Contractor will obtain the services of an independent QC laboratory/firm (when this function is not delegated to the supplier/installer in the Specifications) to ensure QC monitoring/testing of all design components. All QC laboratories/firms will be approved by the Contractor. The latest version of all American Society for Testing and Materials testing standards shall be utilized.

In general, QC test locations will be chosen either randomly or based on identified suspect areas. The final QC tests will be performed on the remaining fractions at the required frequency interval given in Table 7.1. Material quantity estimates are given in Table 7.2.

7.2 QUALITY ASSURANCE

The CQAE will oversee and audit the QC testing equipment, procedures, and results throughout the project to ensure that proper QC testing equipment and methods are used and that accurate QC test results are obtained. The minimum QC testing frequencies are presented in Table 7.1. The CQAE will verify a minimum 5 percent of the field QC test results by performing QA tests on the same materials. If both the QA and the QC test results on a given material meet the Specification requirements, no further action is required. If one organization's test passes and another's fails, the QC test result will be the official test result. However, the CQAE will have the authority, based on his/her judgment, to overrule any QC test result and may require additional tests, repairs, or reworking of a given area/material based solely on the CQAE's test results and/or observations.

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The CQAE or his/her representative will contract with an independent CQA laboratory(s) to perform the conformance testing. The CQAE will review all conformance test results for compliance with the Specifications. All non-conforming test results will be reported to the RM, QCSM, Design Manager, and the Subcontractor. The SQAM will perform continuous QA oversight during construction operations and report to the CQAE.

In addition to the QA activities described above and elsewhere in this QA/QC Plan, the SQAM will perform the following tasks:

- Observe all construction activities to ensure that the Subcontractor is utilizing the construction materials and procedures required by the Project Plans, Specifications, and Design Drawings;
- Review all submittals for conformance with the Project Plans, Specifications, and Design Drawings;
- Prepare the Daily QA Report;
- Review all conformance test results for conformance with the Project Plans, Specifications, and Design Drawings;
- Participate in delineating failing or otherwise unacceptable areas;
- Participate in problem or conflict identification, resolution, and documentation; and
- Participate in all construction meetings.
- Participate in developing proposed alternatives and selecting proposed solutions to Engineering Change Requests.

8.0 REPORTS

8.1 WEEKLY QA REPORT

Following receipt of the Weekly QC Report, the SQAM will prepare a Weekly QA Report that summarizes all Subcontractor QC and QA activities and CQA organization activities. The SQAM will transmit the Weekly QA Report to the CQAE and the Kaiser-Hill RM. Typical types of formal submittals include test data, drawings, instructions, schedules, statements, reports, and certificates. All required submittals must be provided in time to allow for the review, approval, procurements, delivery, and QC preparatory phase of all items before they are needed for construction. As described in Specification Section 1305, Eng. Form 1288–Submittal Register or a similar form will be used for submittal control and scheduling. Eng. Form 4025–Transmittal of Shop Drawings, Equipment Data, Material Samples, or Manufacturer's Certificates of Compliance or a similar form will be used for transmitting submittals.

8.2 CERTIFICATION REPORT

A Certification Report will be prepared, certified by the CQAE, and submitted to Kaiser-Hill for approval. After approval by Kaiser-Hill, the report will be distributed to the EPA, CDPHE, and the DOE with final approval provided by CDPHE. The Certification Report will certify that the landfill was constructed as designed with appropriate modifications during construction.

8.3 CONSTRUCTION COMPLETION REPORT

The Construction Completion Report will, at a minimum, include the following elements:

- A detailed chronology of the construction of the OLF regrade surface, buttress fill, and soil cover;
- A detailed chronology of the construction of the surface water control structures;
- A description of and rationale for any modifications to the Design Drawings and Specifications. All ECRs and RFIs will be included;
- Copies of all QA/QC field and laboratory soil test results;

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- Locations of all field test and samples through global positioning system surveying, shown on appropriate drawings;
- Quantities of all material used for the OLF Cover;
- Copies of key inspection, testing, and other documents, included as appendices;
- As-built drawings and photographs; and
- A summary statement, signed and sealed by the CQAE, that the project was completed in accordance with the CDPHE-approved Plans, Drawings, and Specifications with documented changes included.

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TABLE 7.1

QA/QC SUMMARY
FINAL DESIGN - ORIGINAL LANDFILL DESIGN, RFETS, GOLDEN, COLORADO

Quality Control Item	Specification Section	QA/QC Item	Method	Requirements	QC Action	QA Action
General Project	NA	Submittal	QA/QC Personnel Resumes	Submit to EPA/CDPHE prior to construction.	NA	NA
		RFI Log	Documentation	RFI log will be distributed at the Weekly Progress Meeting	Review	Review
		Daily Reports	Documentation	QA Daily and QC Daily.	Submit QC Dailies to SQAM for Review	Submit QA Report to CTR
Site Preparation	02110	Clearing and Grubbing	Visual Inspection	Vegetation to be removed as much as reasonable possible.	Continuous	Continuous
Regrade and Cover Material (RFA)	02221	Submittal	Proposed Equipment List	Submit prior to use.	Review	Review and approve
		Submittal	Geotechnical Test Results	Submit prior to use.	Review	Review and approve
		Field density	Per test pad results	See Spefication Section 01110 .	Continuous	Oversight of QC
		Atterberg limits	ASTM D 4318	Consistent with initial borrow area sampling.	1/6,500 cy	1 per 20 QC samples (minimum of 1)
		Sieve analysis (with USCS classification)	ASTM D 422 and ASTM D 5519	Consistent with initial borrow area sampling.	1/6,500 cy	
		Placement Documentation	Visual Inspection	In accordance with Specification Section 02221.	Continuous	Oversight of QC
Buttress Fill Material	02221	Submittal	Geotechnical Test Results	Submit prior to use.	Review	Review and approve
		Field density	ASTM D 2922	95% of maximum dry density +/- 2 percent optimum moisture content.	1/5,000 ft2/lift	1 per 20 QC samples (minimum of 1)
		Field Density Calibration	Standard Counts	Conduct daily standard counts per Manufacturer's instructions.	Daily when device is used	Oversight of QC
		Field Density Verification	ASTM D 1556, ASTM D 2167	Verify ASTM D 2922 results.	1/20 field density	Oversight of QC
		Field Moisture Verification	ASTM D 2216	Verify ASTM D 2922 moisture.	1/20 field density	Oversight of QC
		Failed Density Test	ASTM D 2922	Two confirmatory tests adjacent to failed test. If either fails, area needs to be reworked.	As needed	Oversight of QC
		Laboratory compaction	ASTM D 698	Report	1/6,500 cy	1 per 20 QC samples (minimum of 1)
		Atterberg limits	ASTM D 4318	Consistent with initial borrow area sampling as determined by the CQAE.	1/6,500 cy	
		Sieve analysis (with USCS classification)	ASTM D 422	Consistent with Specification Section 02221 Table A.	1/6,500 cy	
		Placement Documentation	Visual Inspection	In accordance with Specification Section 02221.	Continuous	Continuous
Drain Rock	02222	Submittal	Proposed Equipment List	Submit prior to use.	Review	Review and approve
		Submittal	Geotechnical Test Results	Submit prior to use.	Review	Review and approve
		Submittal	Certified Waybills	Submit prior to use.	Review	Review and approve
		Sieve analysis	ASTM C 136 or ASTM D 5519	See Specification 02222-2.01.	1/6,500 cy	1 per 20 QC samples (minimum of 1)
		LA abrasion	ASTM C 131	≤ 10% loss for 100 revs or ≤ 40% loss for 500 revs	1/25,000 cy	1 per 20 QC samples (minimum of 1)
		Sodium sulfate soundness	ASTM C 88	≤ 10% loss		
		Absorption	ASTM C 127	2% or less		
		Placement Documentation	Visual Inspection	In accordance with Specification Section 02222.	Continuous	Oversight of QC

TABLE 7.1

QA/QC SUMMARY
FINAL DESIGN - ORIGINAL LANDFILL DESIGN, RFETS, GOLDEN, COLORADO

Quality Control Item	Specification Section	QA/QC Item	Method	Requirements	QC Action	QA Action
Riprap and Riprap Bedding	02245	Submittal	Proposed Equipment List	Submit prior to use.	Review	Review and approve
		Submittal	Geotechnical Test Results	Submit prior to use.	Review	Review and approve
		Submittal	Certified Waybills	Submit prior to use.	Review	Review and approve
		Field gradation	Visual Inspection	See Specifcation Section 02245, Table A.	1/Material type (i.e., 6-inch or 9-inch riprap, or bedding material)	1 per 20 QC samples (minimum of 1)
		Sieve analysis	ASTM C 136 or ASTM D 5519	See Specifcation Section 02245, Table A.	1/Material type (i.e., 6-inch or 9-inch riprap, or bedding material)	1 per 20 QC samples (minimum of 1)
		Placement Documentation	Visual Inspection	In accordance with Specification 02245	Continuous	Oversight of QC
Geotextile	02223	Submittal	Manufacturer's QC data.	Submit prior to use.	Review	Review and approve
		Mass per unit area	ASTM D 5261	8 oz/yd2	1/100,000 ft2	1 per 20 QC samples (minimum of 1)
		Placement Documentation	Visual Inspection	In accordance with Specification 02223.	Continuous	Oversight of QC
Seeding	02900	See requirements in Specification Section 02900.	See requirements in Specification Section 02900.	See requirements in Specification 02900.	See requirements in Specification Section 02900.	See requirements in Specification Section 02900.
As-Built Surveys	01310	See requirements in Specification Sections 01310 and 01720.	See requirements in Specification Sections 01310 and 01720.	Verify elevations required by design.	As required	As required, at the discretion of the CQAE.

Notes:

Test methods refer to American Society for Testing and Materials (ASTM) standard test methods.
* = Minimum of one test per backfill area.
≤ = less than or equal
% = percent
+/- = plus or minus
CDPHE = Colorado Department of Public Health and Environment
CQAE = Construction Quality Assurance Engineer
CTR = Contractor's Technical Representative
cy = cubic yards (volume based on "in place" volume)
EPA = Environmental Protection Agency
ft2 = square foot
LA = Los Angeles
NA = not applicable
oz/yd2
QA = quality assurance
QC = quality control
revs = revolutions
RFA = Rocky Flats Alluvium
RFI = Request for Information/Clarification
SQAM = Site Quality Assurance Manager
USCS = Unified Soil Classification System

TABLE 7.2

MATERIAL QUANTITIES[1]
ORIGINAL LANDFILL DESIGN, RFETS, GOLDEN, COLORADO

Material	Quantity	Unit
Regrade Material (RFA)[2]	45,000	bank cubic yards
Soil Cover Material (RFA)	39,000	bank cubic yards
Diversion Berm Soil	5,900	bank cubic yards
Butress Fill Material	52,000	bank cubic yards
Drain Rock	9,000	bank cubic yards
Erosion Matting (C125)	83,000	square yards
Erosion Matting (C350)	6,800	square yards
Erosion Matting (P550)	7,000	square yards
Georidge	840	linear feet
Geogrid	9,500	square yards
24-inch Boulders	88	total

Notes:

[1]Quantities are based on the Regulatory Review Design Drawings and will be modified upo completion of the design.

[2]Regrade material quantity represents volume to be imported from off-site borrow area.

RFA = Rocky Flats Alluvium

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ATTACHMENT 1

SAMPLE PROJECT FORMS

Client: RFETS

Project: OLF

Project #:

Contractor(s):

Contractor Super(s):

Date:

Contract #:

Weather:

Temperature **High:** **Low:**

Daily Notations:

QC Action Items:

ACTION	COMPLETED

QCSM Signature

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QUALITY ASSURANCE REPORT

Client: RFETS

Project: OLF

Project #:

Contractor(s):

Contractor Super(s):

Date:

Contract #:

Weather:

Temperature **High:** **Low:**

Daily Notations:

QA Action Items:

ACTION	COMPLETED

SQAM Signature

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Field Density Test Report (Nuclear Density Test)

Date: | **Project:** RFETS OLF
Daily Report No.: | **Project No.:**
Technician: | **Gauge Number:**

Test Number	Soil Type	Approximate Northing	Approximate Easting	Lift	Probe Depth (Inches)	Wet Density (Pcf)	Dry Density (Pcf)	Moisture (Pcf)	Moisture (%)	Opt. Moisture Req. (%)	Proctor (Pcf)	% Compaction

Project Requirements:
Min. % Compaction: | **Passed:** ____________________
Max. % Compaction:

MATERIAL DELIVERY/INVENTORY CHECKLIST

Project Name: Project Number: QCSM Name:

Material Type	Quantity	Vendor	Damage / Remarks

SUBMITTAL REGISTER

PROJECT ______________
JOB NUMBER ______________ PAGE ______________
LOCATION ______________ DATE ______________

Section Description	Section No.	Para. No.	Component	Description of Item	Transmittal No.	Submittal Classification[1]	Submission Date	Approval Date	Remarks

[1] Submittals shall be classified as D (Designer of Record Approval), QA (CQAE Approval), or FIO (For Information Only).

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EarthTech
A Tyco International Ltd. Company

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE		**TRANSMITTAL NO.:** **DATE:**			
To:	**From:**				
Specification Sec. No.	**Project Title and Location:**				
Item No.	**Description of Item Submitted**	**No. of Copies**	**Spec. Para. No.**	**Drawing Sheet No.**	**Variation**
REMARKS		I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted. NAME AND SIGNATURE OF CONTRACTOR			

NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	**DATE**

REQUEST FOR INFORMATION

PROJECT ______________________ RFI NO. ______________________
JOB NUMBER ______________________ PAGE ________ OF ________
LOCATION ______________________ RFI DATE ______________________
REPLY DATE ______________________

TO ______________________ COMPANY ______________________
SUBJECT ______________________ LOCATION ______________________
DRAWING NO. ______________________ SPEC. NO. ______________________

INFORAMTION REQUESTED:

REPLY REQUIRED BY ______________________

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE ______________________ DATE ______________

POTENTIAL IMPACT NOTICE

__ SCHEDULE
__ LABOR
__ MATERIAL
__ NO IMPACT
__ OTHER ________

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

RM ______________________ DATE ______________

DM ______________________ DATE ______________

CQAE ______________________ DATE ______________

CDPHE REPRESENTATIVE ______________________ DATE ______________

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ENGINEERING CHANGE REQUEST

PROJECT ____________________ ECR NO. ____________________

JOB NUMBER ____________________ PAGE __________ OF __________

LOCATION ____________________ RFI DATE ____________________

REPLY DATE ____________________

TO ____________________ COMPANY ____________________

SUBJECT ____________________ LOCATION ____________________

DRAWING NO. ____________________ SPEC. NO. ____________________

CHANGE REQUESTED

REPLY REQUIRED BY ____________________

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

____________________ CONTRACTOR REP SIGNATURE

____________________ DATE

POTENTIAL IMPACT NOTICE

__ SCHEDULE
__ LABOR
__ MATERIAL
__ NO IMPACT
__ OTHER ____________

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

____________________ RM ____________ DATE

____________________ DM ____________ DATE

____________________ CQAE ____________ DATE

____________________ CDPHE REPRESENTATIVE ____________ DATE

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APPENDIX C

PROJECT PHOTOGRAPHIC LOG

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Photo 1: A westward view of the Original Landfill prior to construction activities showing the south interceptor ditch on the left (May 2005).

Photo 2: A southwesternly view of the Original Landfill at the beginning of construction activities (May 2005).

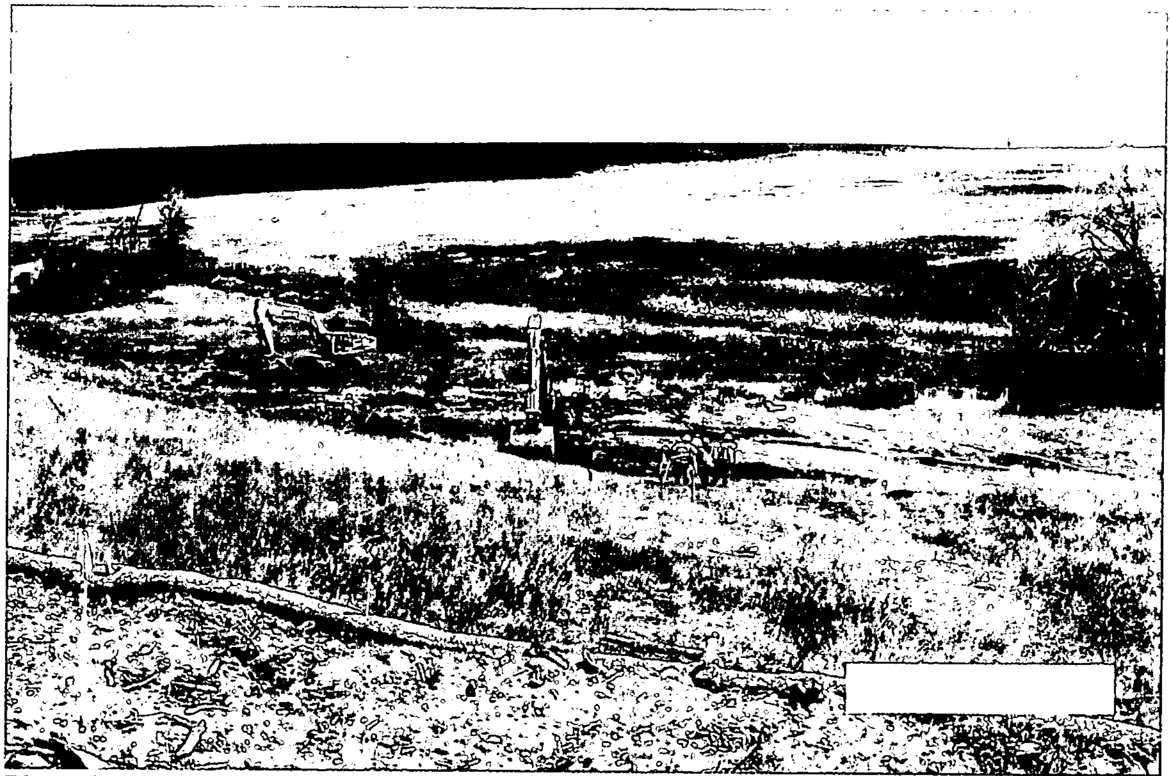

Photo 3: A view of the buttress footprint grubbing showing temporary erosion controls (May 2005).

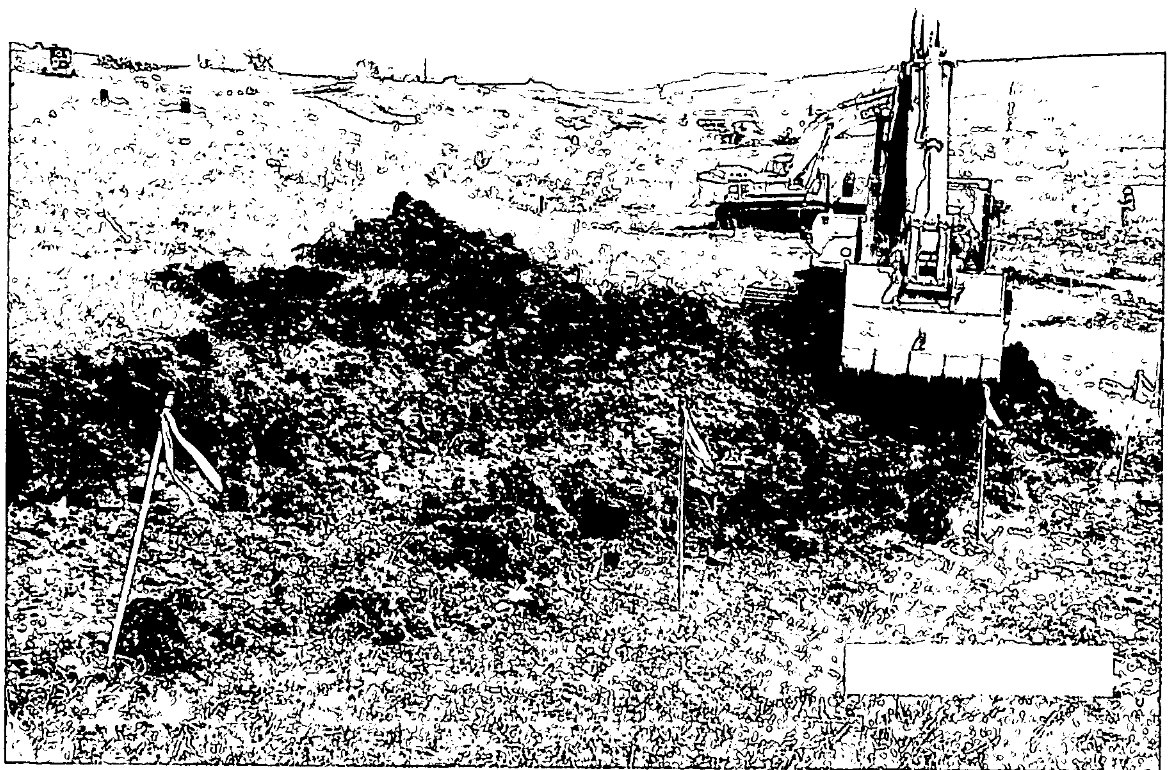

Photo 4: A view of the buttress footprint grubbing (May 2005).

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Photo 5: A view of the buttress footprint grubbing (May 2005).

Photo 6: A view of the grubbing in the east end of the regrade fill (May 2005).

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Photo 7: A view of the buttress subgrade with the geogrid and stockpiled drain rock (May 2005).

Photo 8: A view of the regrade area from the buttress (May 2005).

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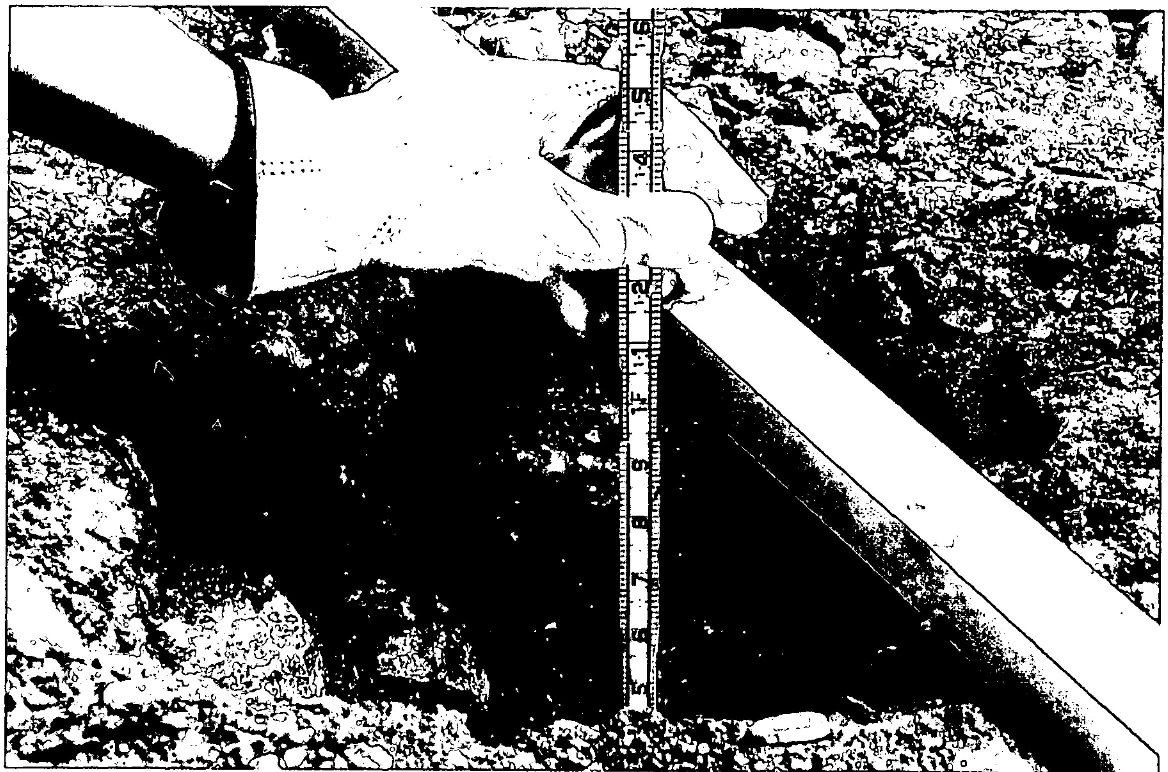

Photo 9: A view of the percolation test holes at the bottom of the buttress (May 2005).

Photo 10: The middle road through the site showing exclusion zone. (May 2005).

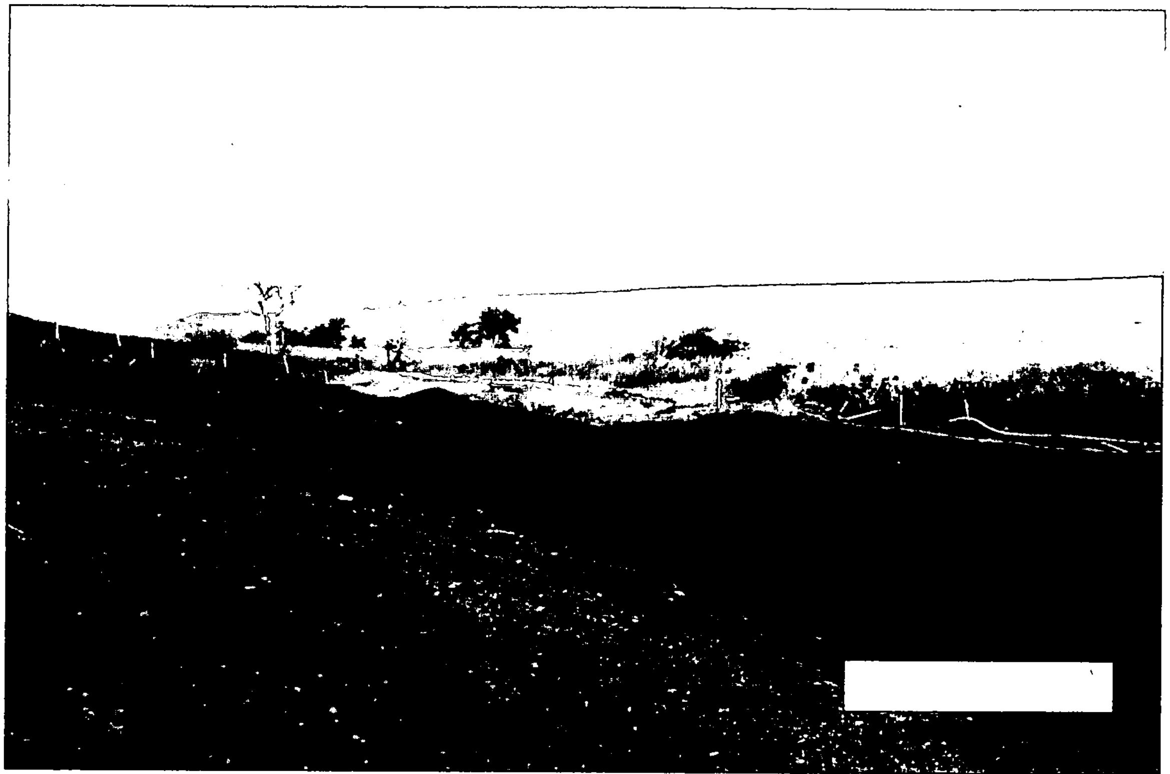
Photo 11: The geogrid placed on the buttress subgrade. (May 2005).

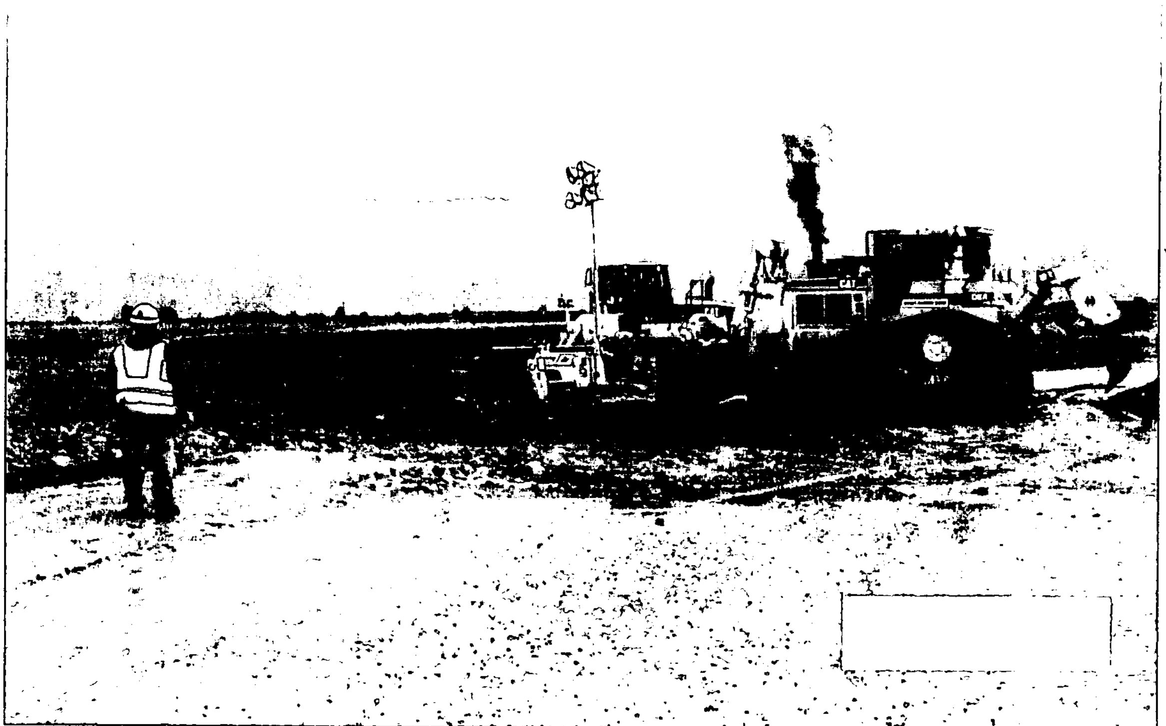
Photo 12: North crest of the regrade fill (May 2005).

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Photo 13: A view of one of the test pits along the existing natural gas line to determine if any waste was a foot below the existing grade (June 2005).

Photo 14: A view of the buttress drain rock from the southwest (June 2005).

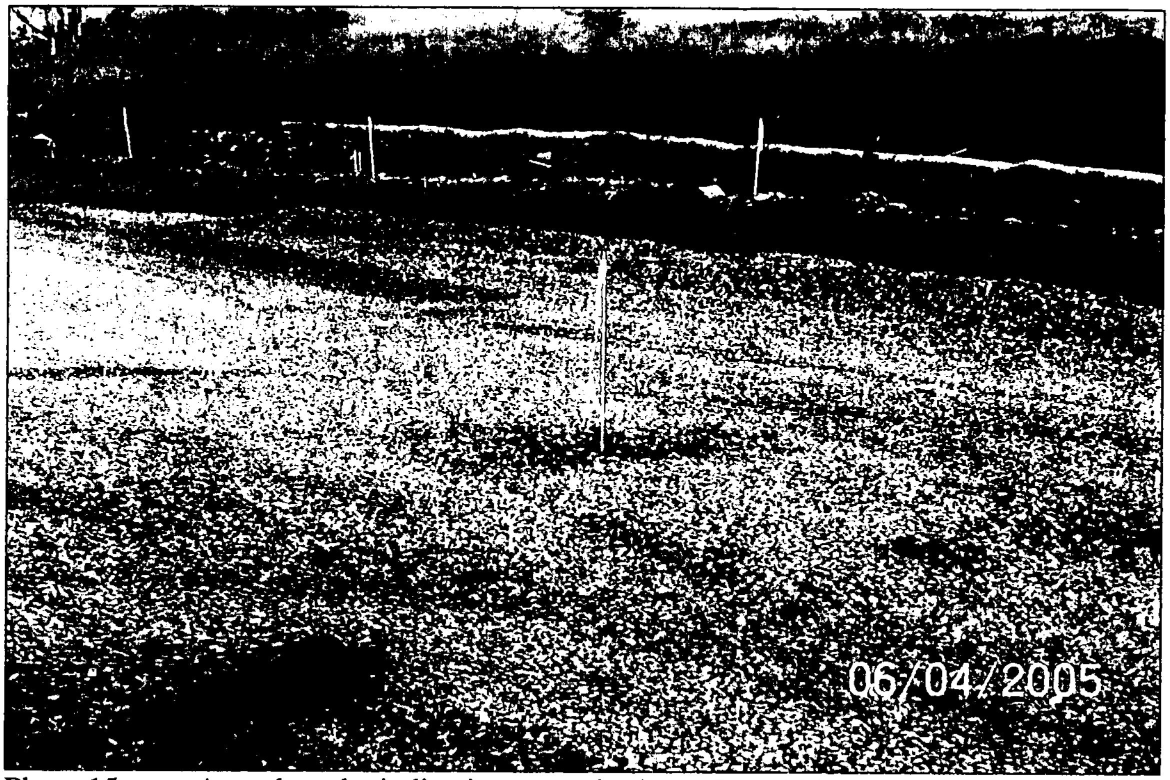

Photo 15: A grade stake indicating a required cut (June 2005).

Photo 16: A survey shot for a drain rock sample location (June 2005).

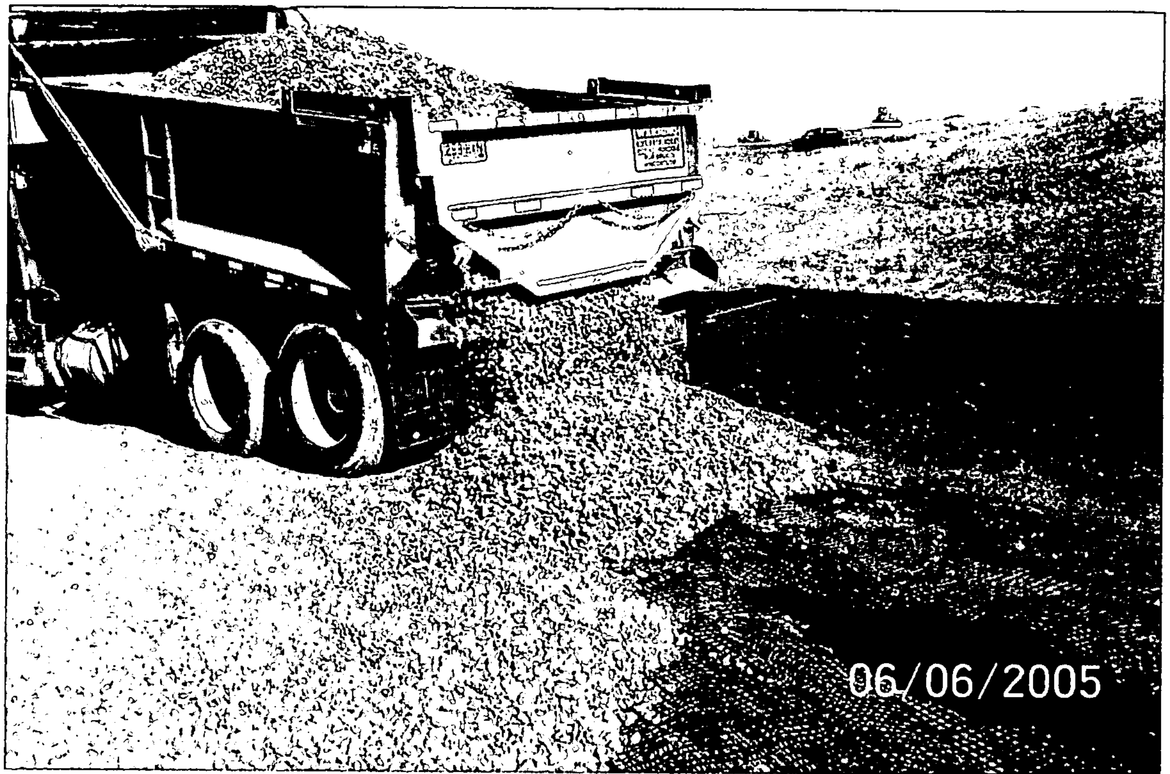

Photo 17: A view of the imported drain rock placed over the geogrid (June 2005).

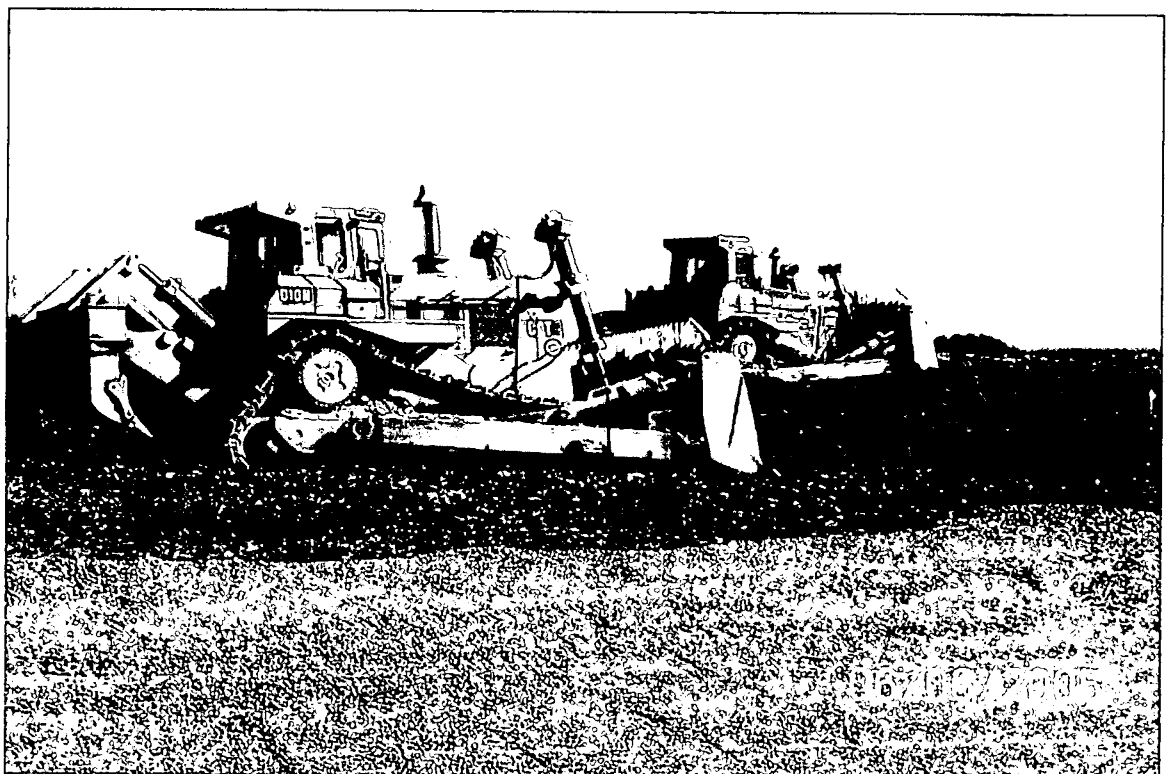

Photo 18: A view of the regrade directly north of the buttress (June 2005).

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Photo 19: A view along the buttress toe keyway of the anchored geotextile prior to folding it over (June 2005).

Photo 20: A view of a 310G backhoe working on the geotextile anchor in the keyway (June 2005).

Photo 21: QC collecting drain rock sample number three (June 2005).

Photo 22: A view from the bottom of the buttress at the drain rock on the slope. QC's drain rock sample location is visible in the middle of the photo (June 2005).

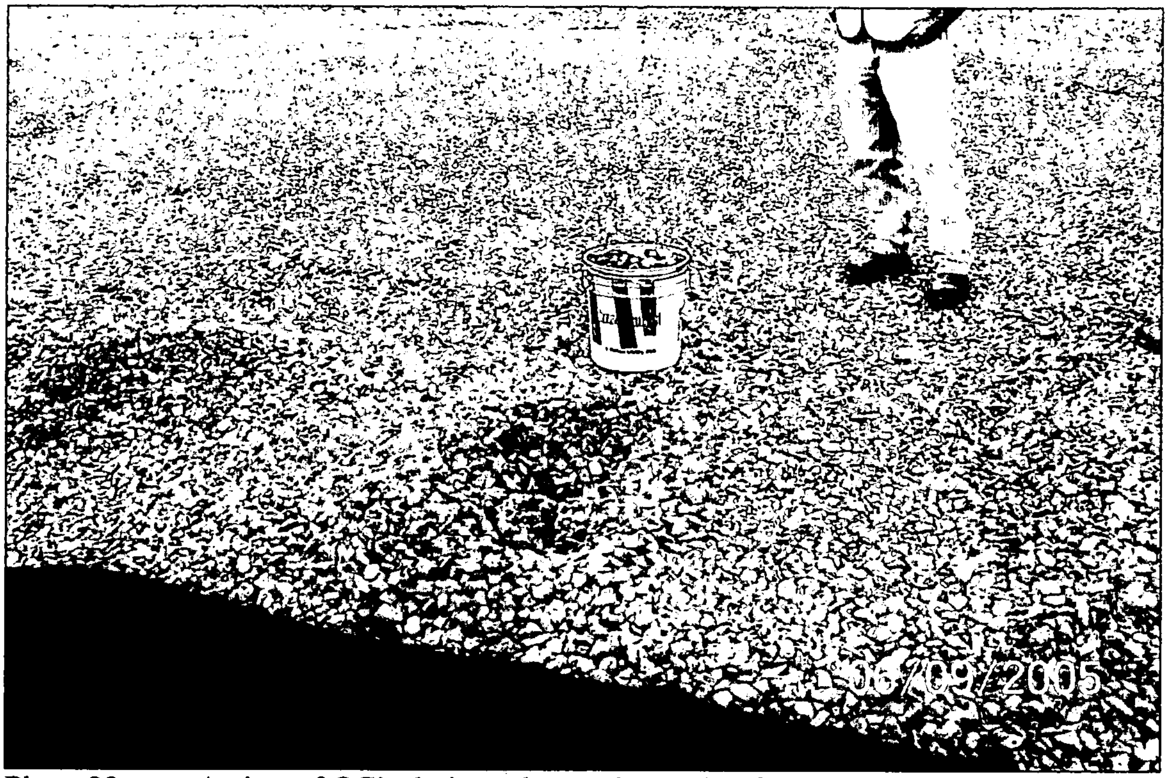

Photo 23: A view of QC's drain rock sample number four location (June 2005).

Photo 24: The first day of buttress fill placement along the keyway (June 2005).

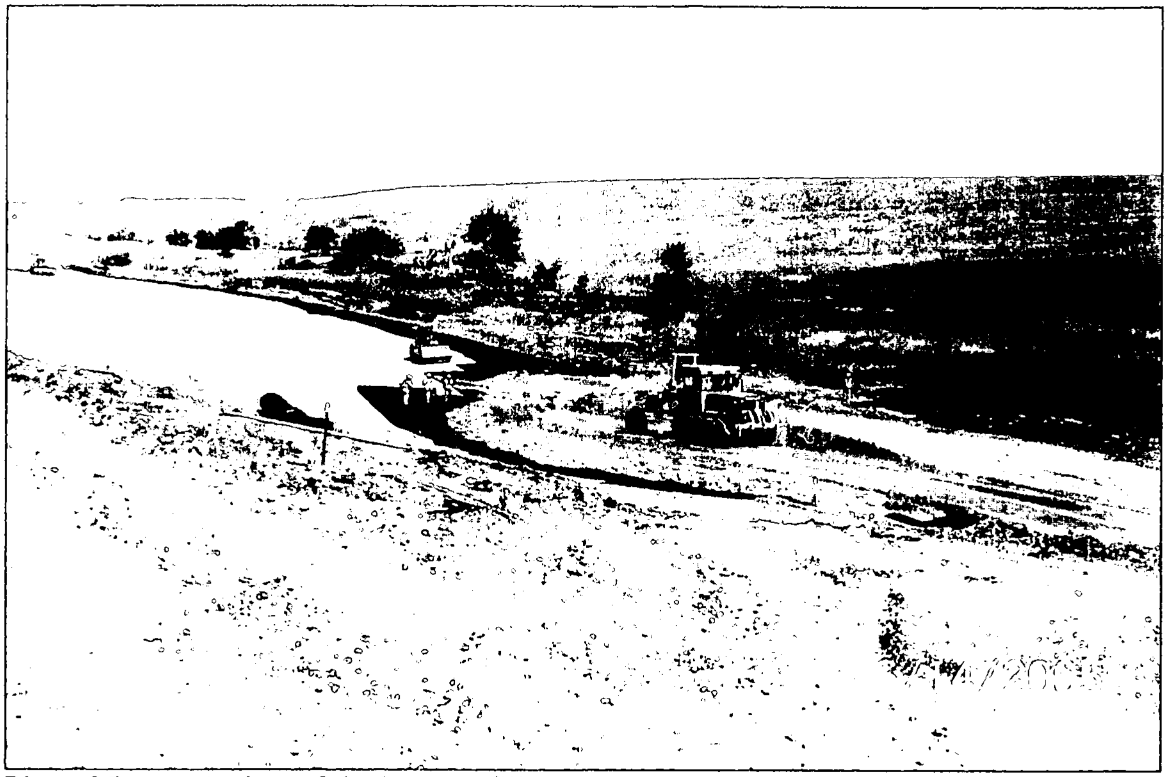

Photo 25: A view of the buttress fill construction, which also shows the smooth drum compacting the drain rock to the east of the buttress fill placement (June 2005).

Photo 26: A view south from the top of the regrade across the site (June 2005).

Photo 27: A view of the regrade activities within the exclusion zone (June 2005).

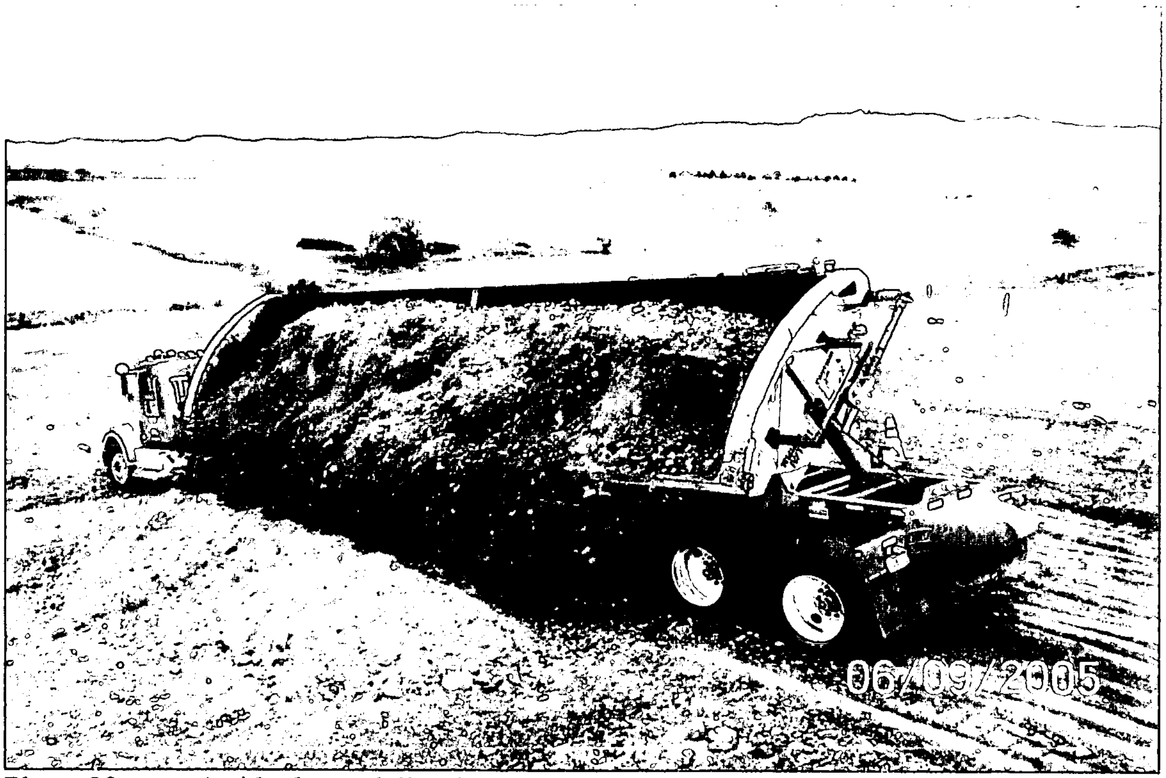

Photo 28: A side dump delivering Rocky Flats Alluvium (RFA) (June 2005).

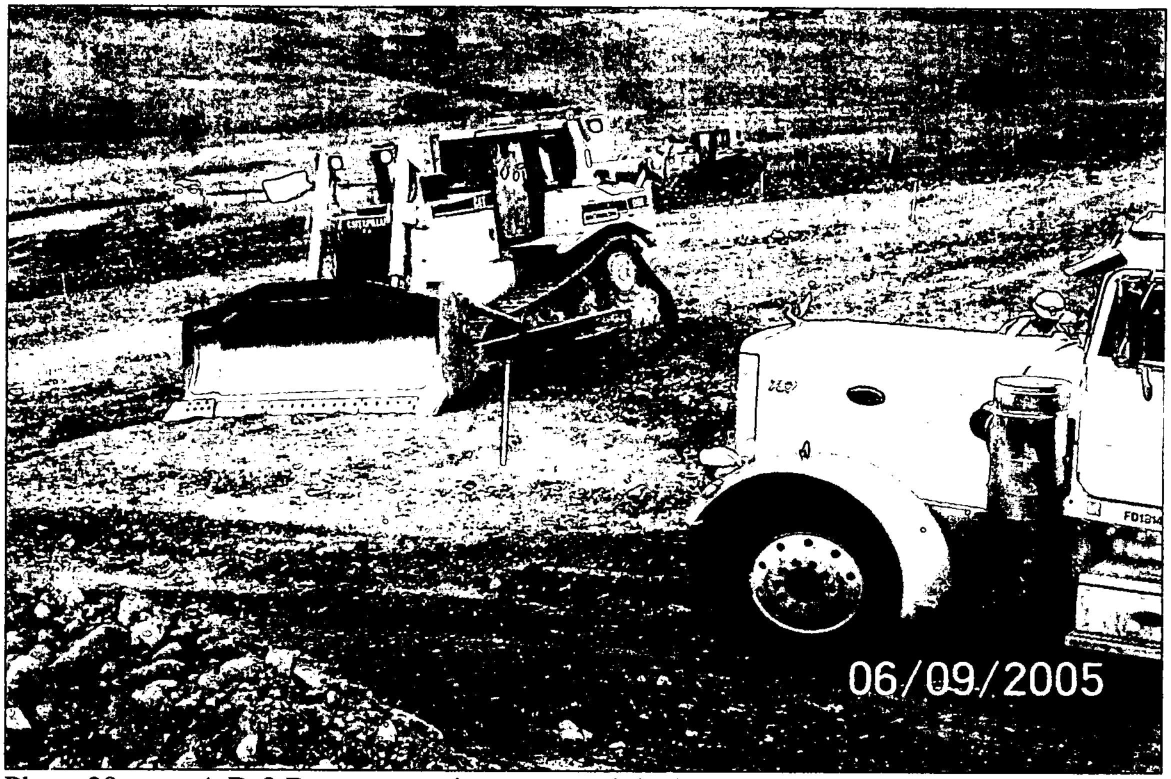

Photo 29: A D-8 Dozer preparing to spread the imported RFA (June 2005).

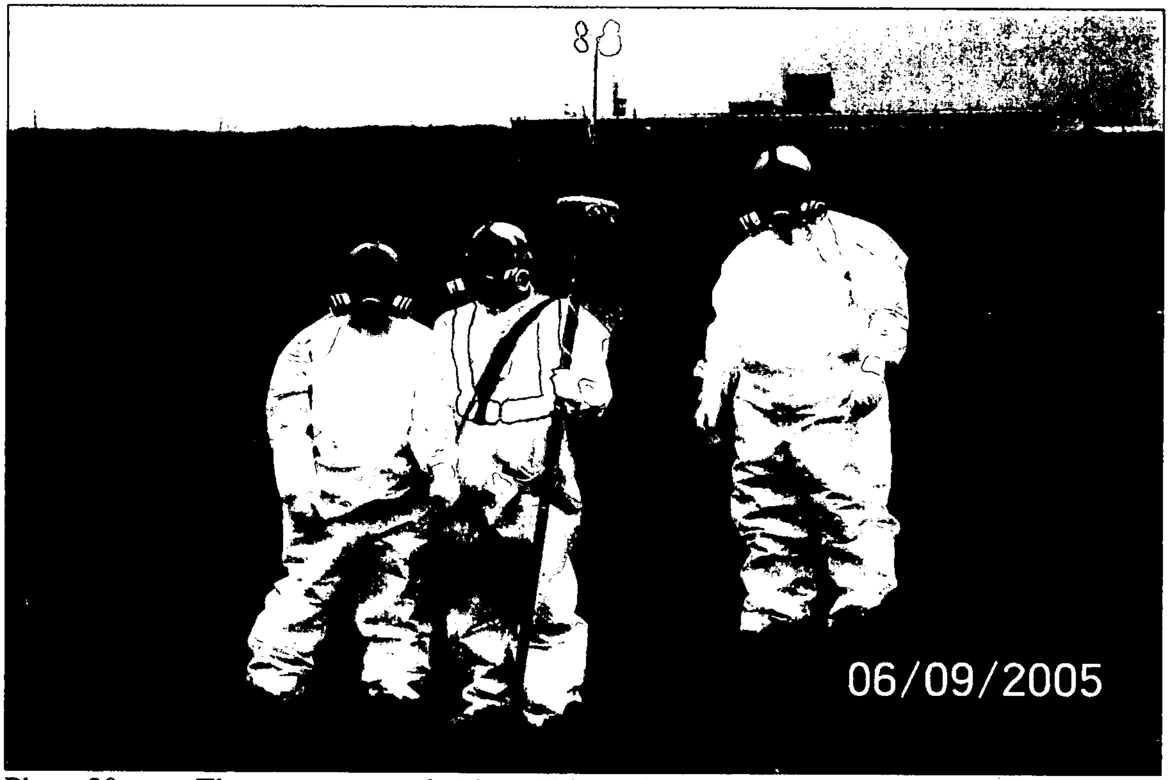

Photo 30: The survey crew that is working within the exclusion zone in Level C PPE (June 2005).

Photo 31: The first lift of the buttress fill being placed on top of the geotextile and drain rock (June 2005)

Photo 32: A view of a CAT 966G front end loader spreading the buttress fill for compaction on the first lift (June 2005).

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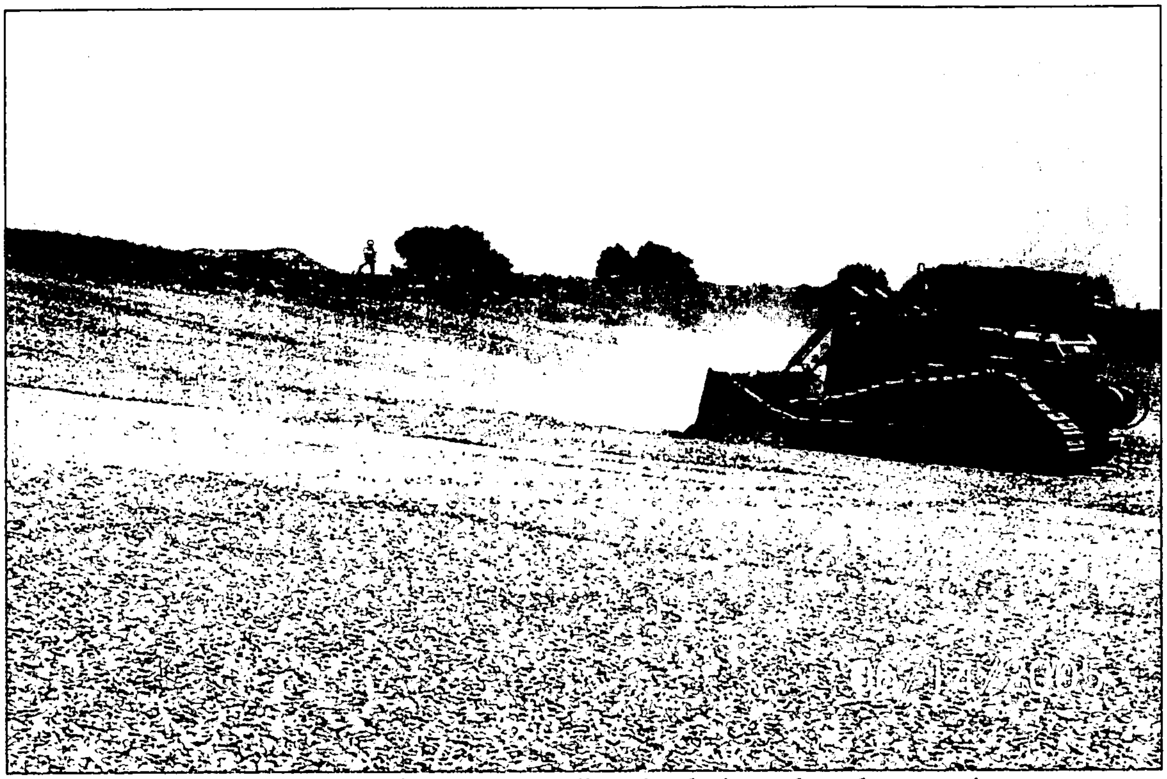

Photo 33: A view of a D-6 Dozer spreading the drain rock and attempting to remove the areas with high fines content (June 2005).

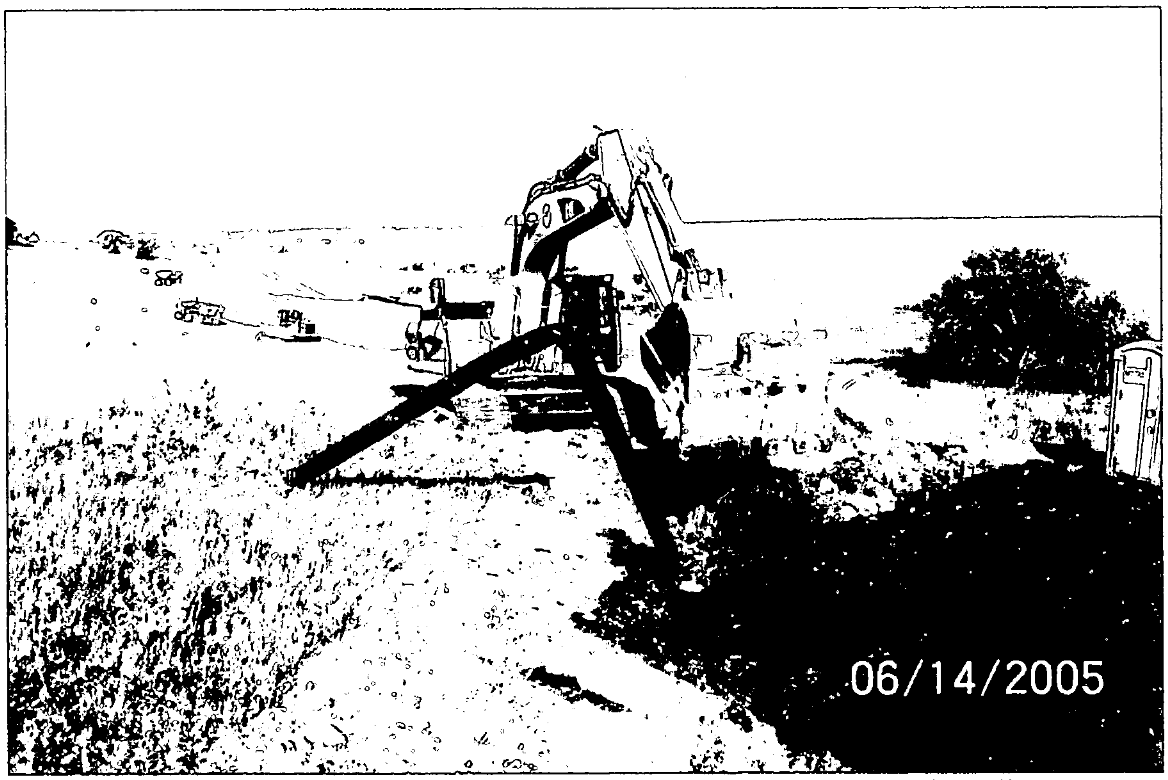

Photo 34: A 450 Excavator working on removing an old abandoned gas line (June 2005).

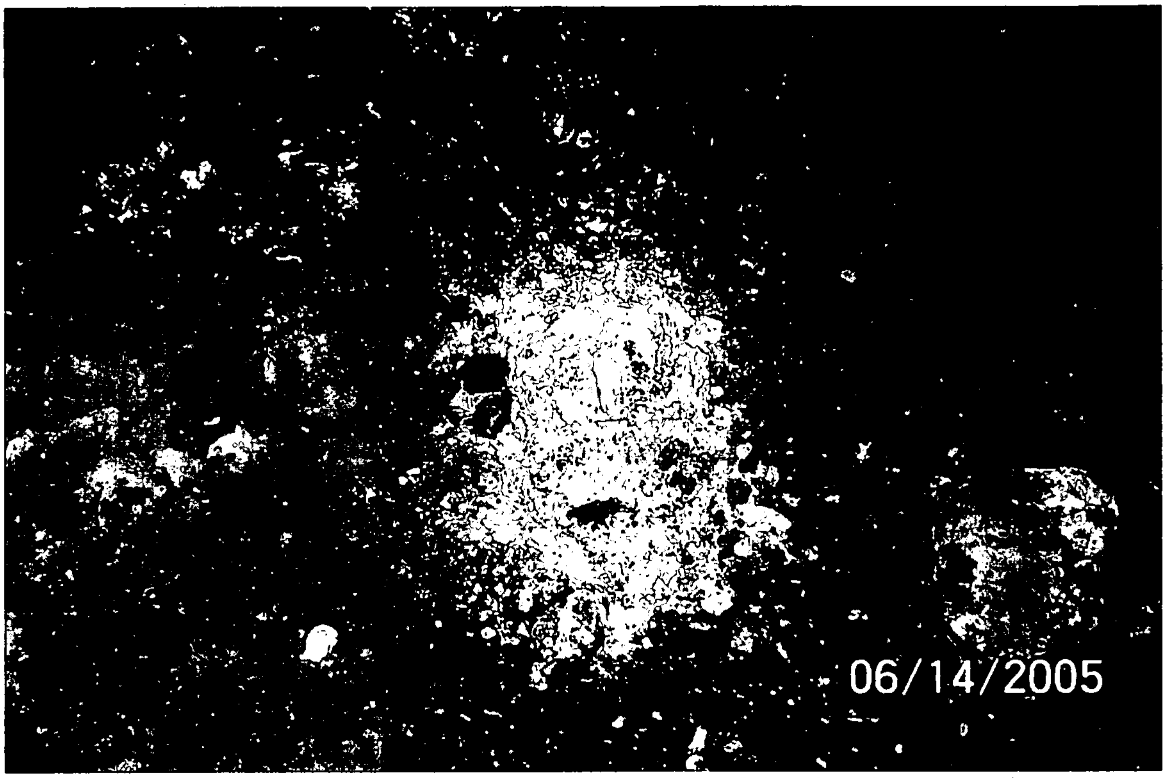

Photo 35: A view of the grout installed at the ends of the abandoned gas line (June 2005).

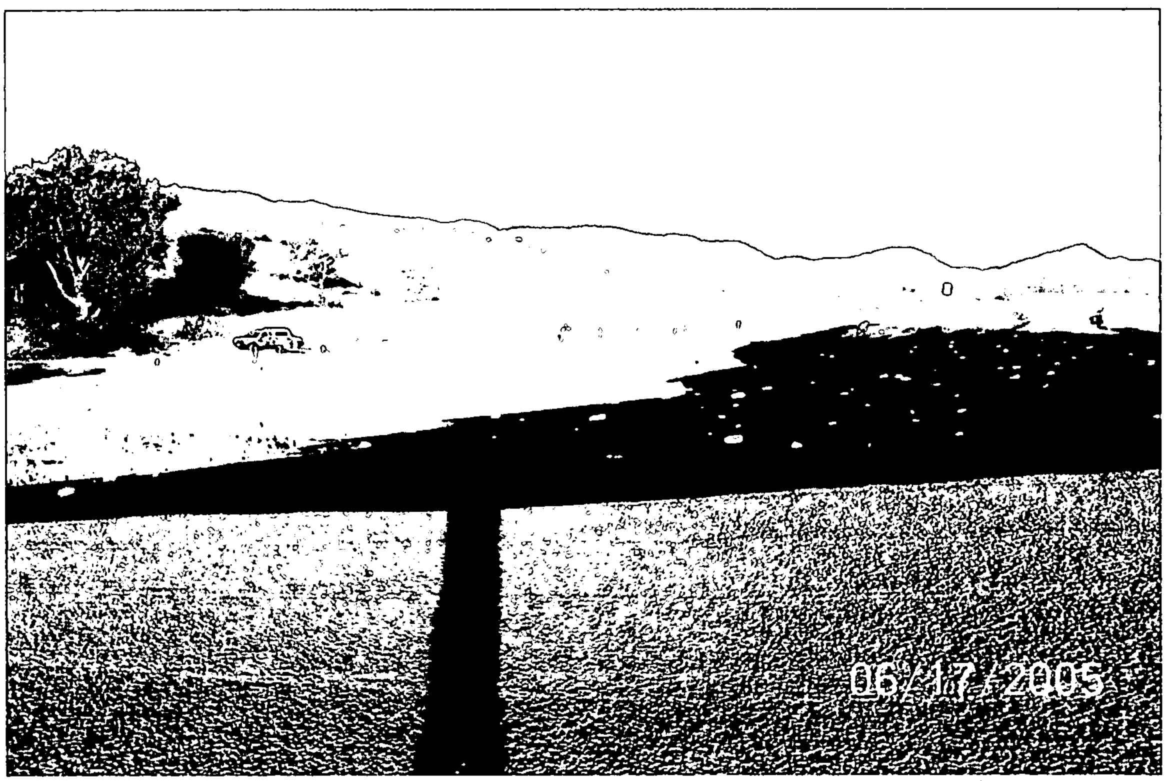

Photo 36: A view to the west of the drain rock, geotextile and buttress fill (June 2005)

Photo 37: The geotextile at the top of the buttress prior to installing the anchor trench (June 2005).

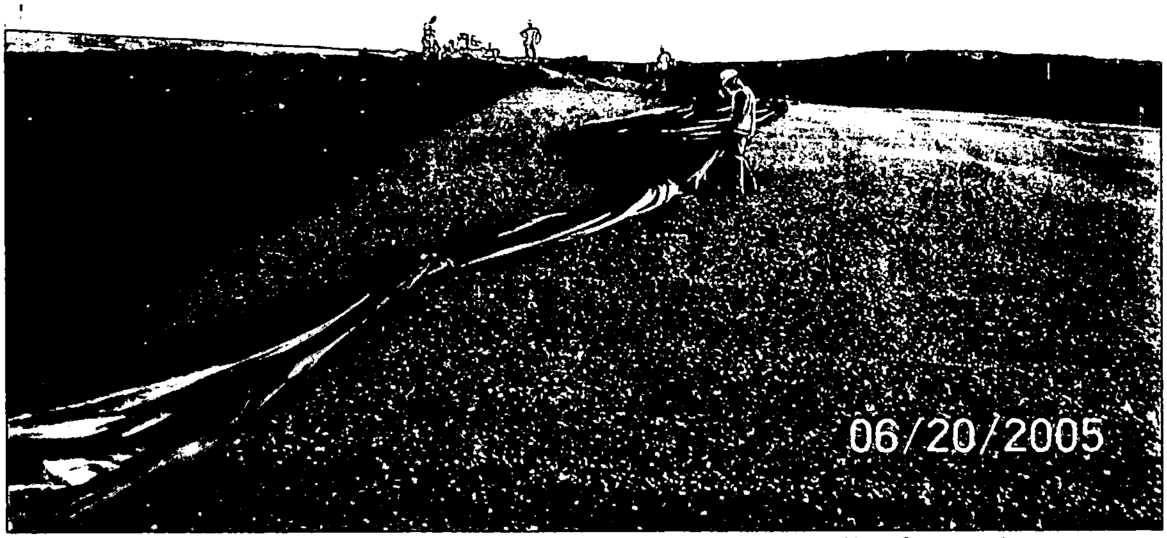

Photo 38: A view of the contractor spreading out the geotextile after moderate winds (June 2005).

Photo 39: A view of the contractor scarifying the buttress fill prior to placement of additional fill (June 2005).

Photo 40: A view of a 966G Loader placing buttress fill on the slope of the buttress (June 2005).

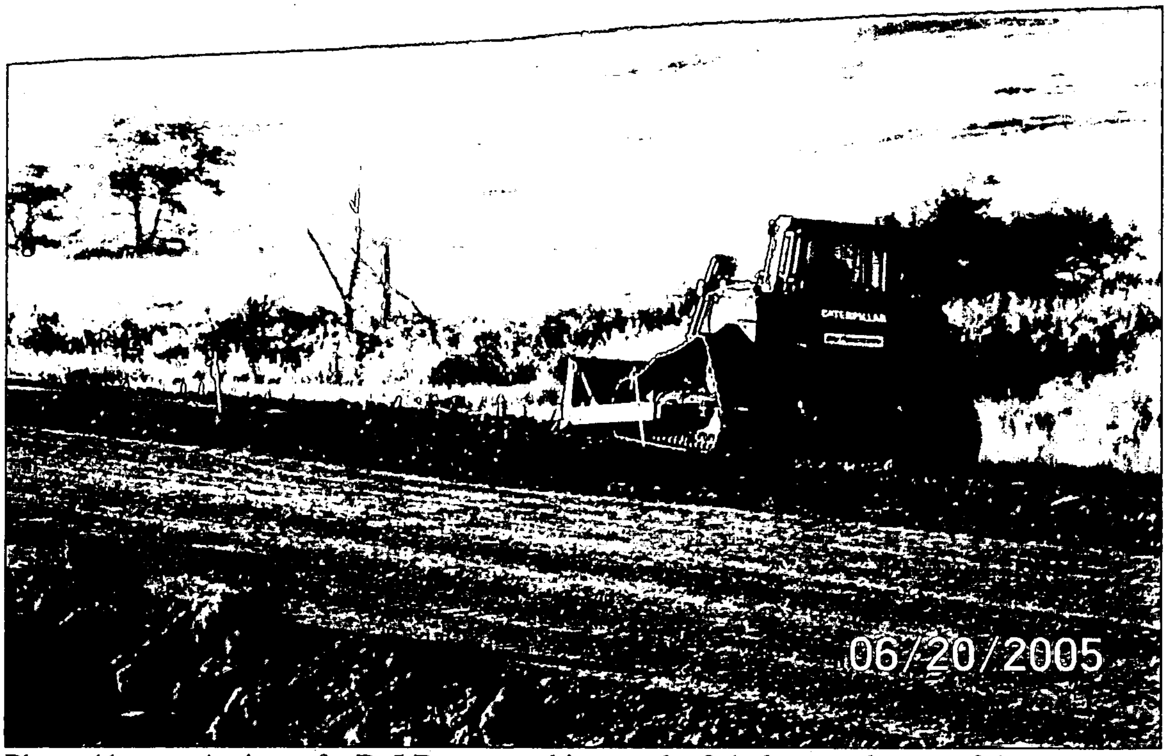

Photo 41: A view of a D-5 Dozer working on the 3:1 slope at the toe of the buttress (June 2005).

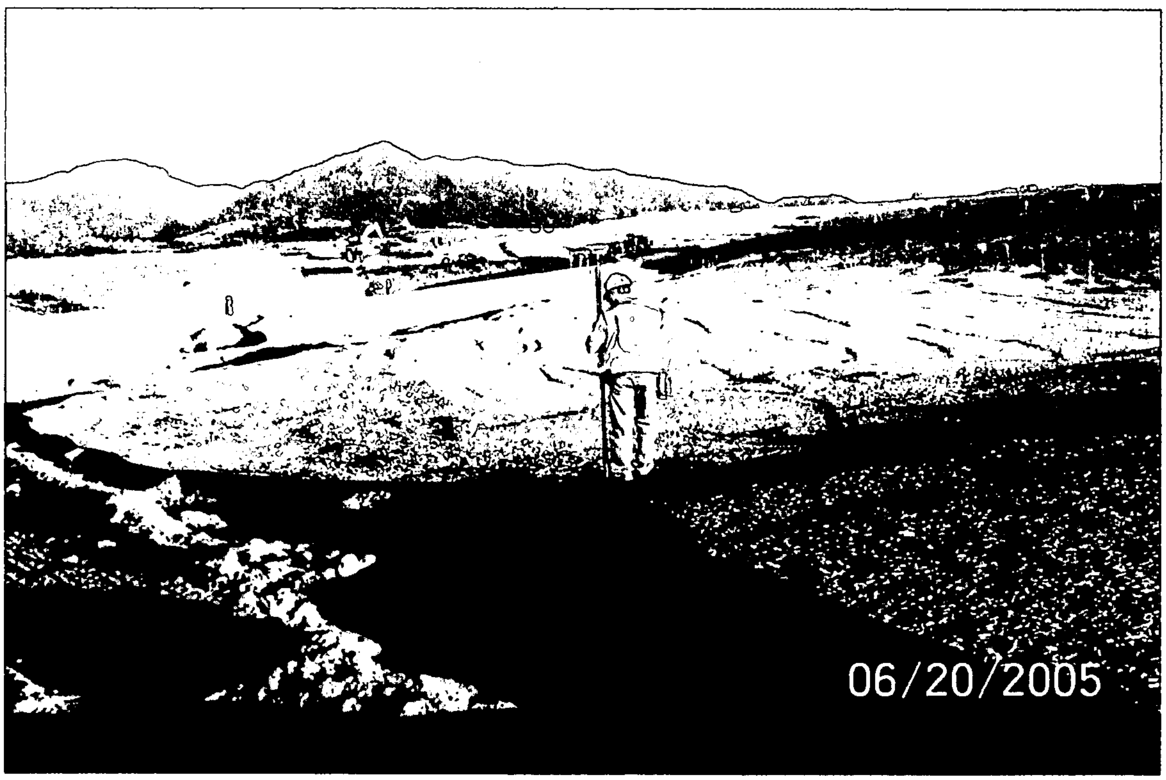

Photo 42: A view of survey collecting as-built shots on the buttress slope (June 2005).

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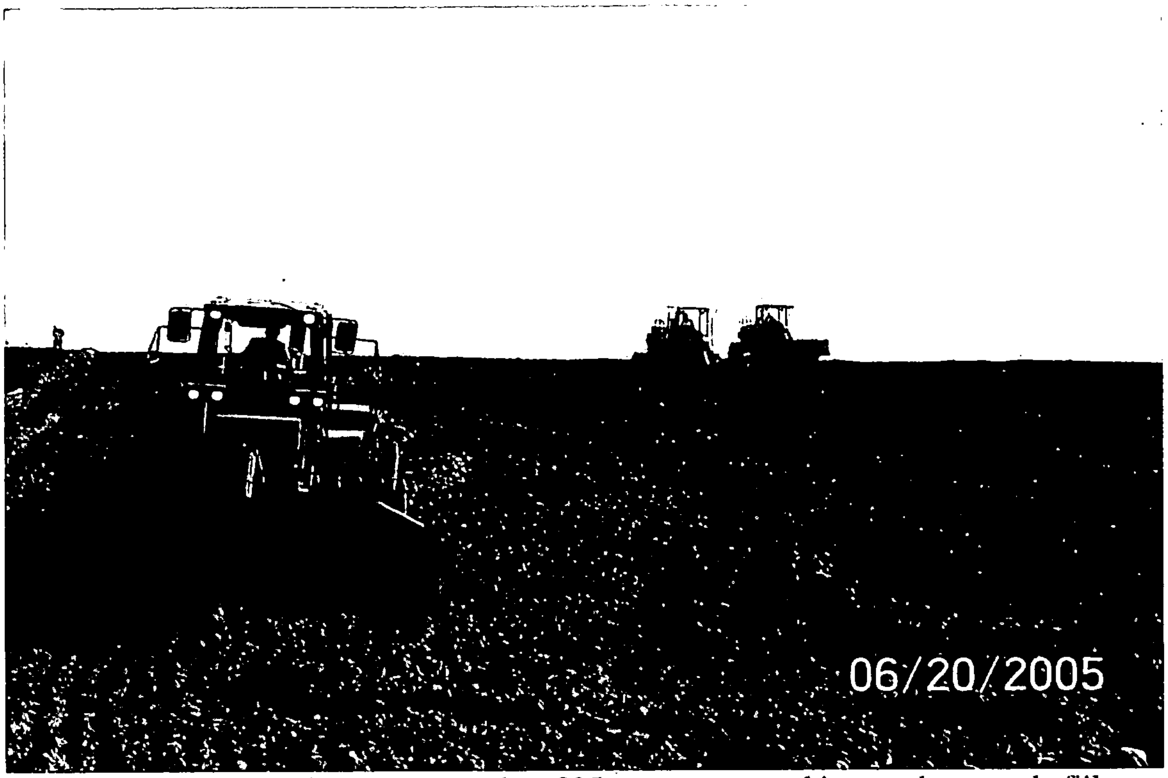

Photo 43: (2) 815 Compactors and an 825 compactor working on the regrade fill (June 2005).

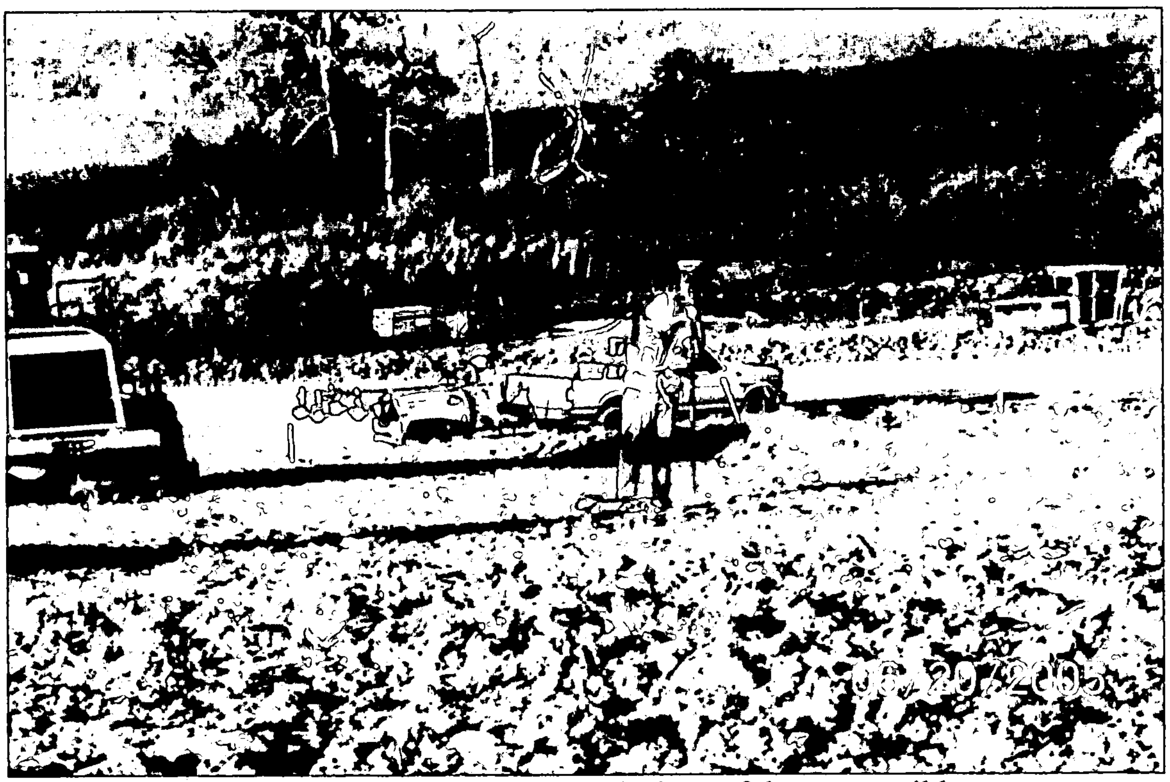

Photo 44: Survey verifying SG-2 grade at the base of the cover soil layer (June 2005).

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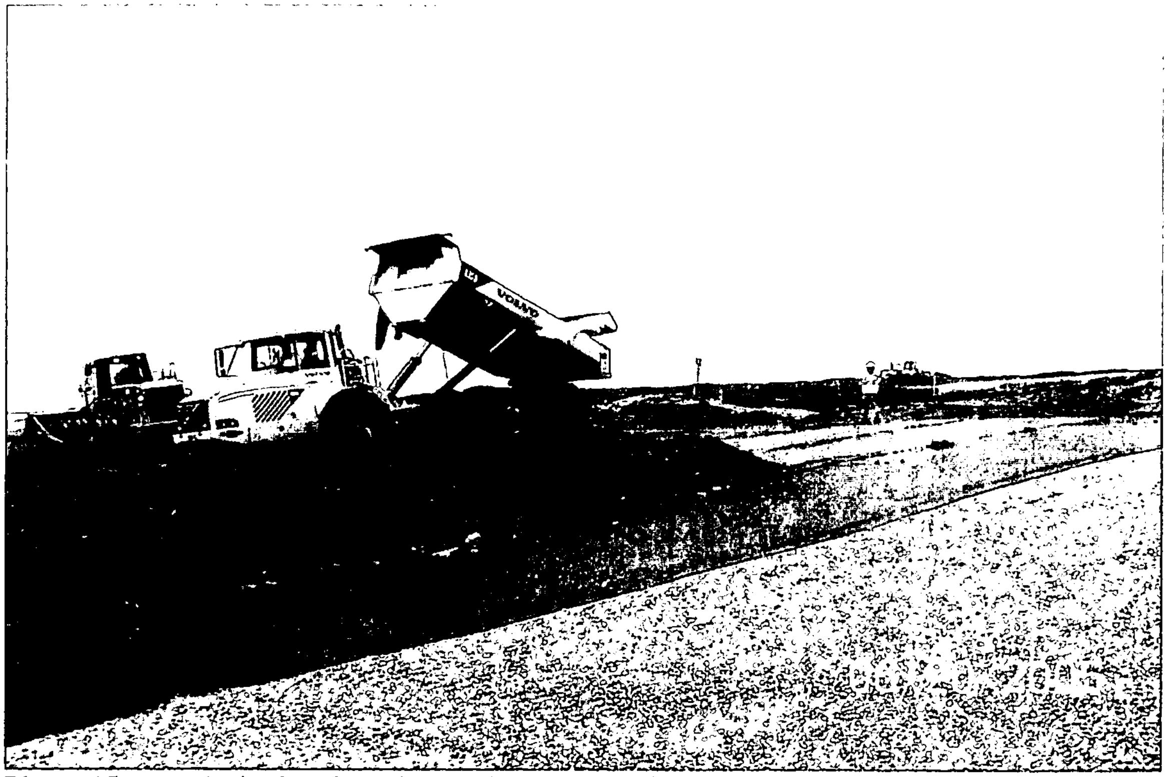

Photo 45: Articulated trucks placing buttress fill on the slope of the buttress (June 2005).

Photo 46: An overall view of the entire site from the south (June 2005).

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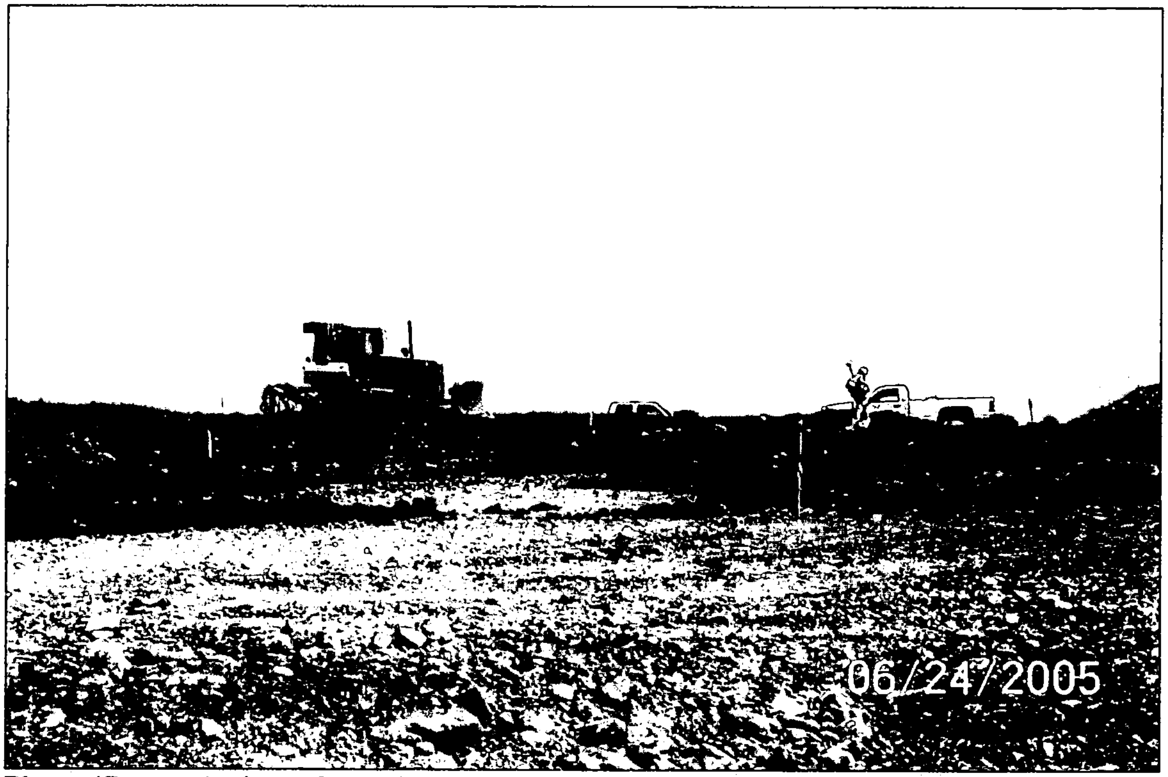

Photo 47: A view of a D-5 dozer grading the cover soils. The black topsoil from the east stockpile was placed prior to the RFA cover soils (June 2005).

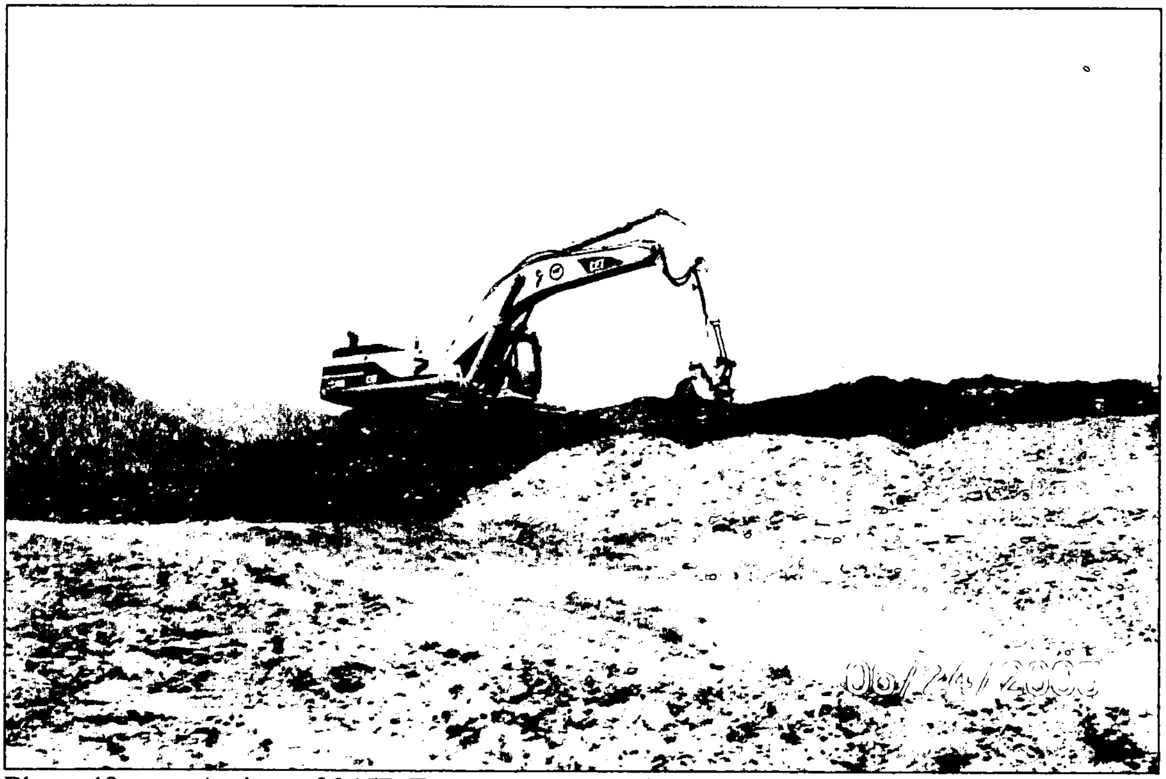

Photo 48: A view of 345B Excavator excavating the West Outfall Channel (June 2005).

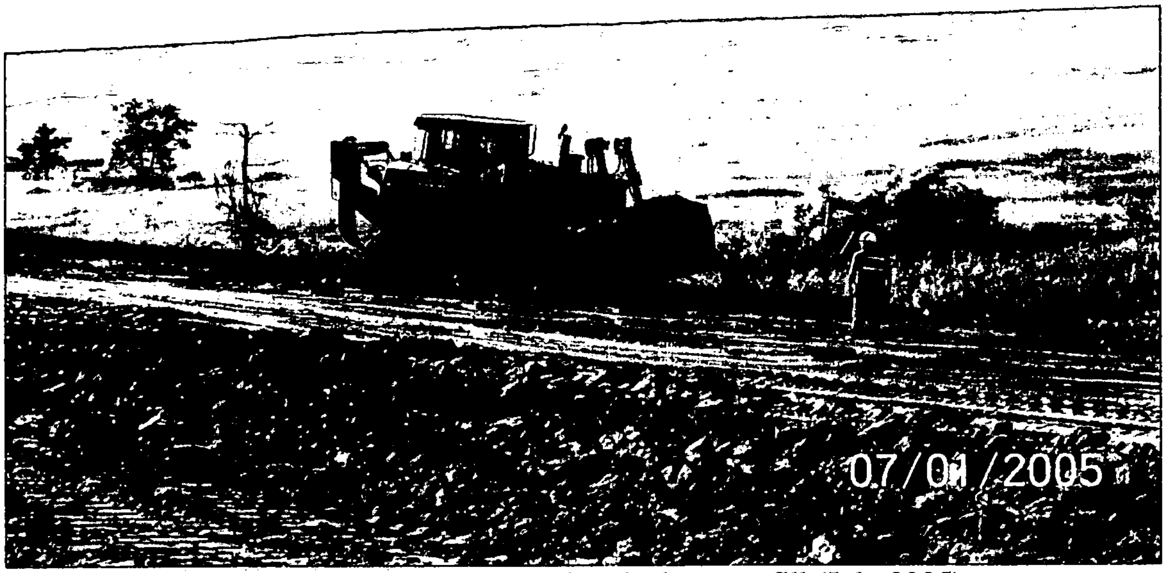

Photo 49: A view of a D-8 Dozer working the buttress fill (July 2005).

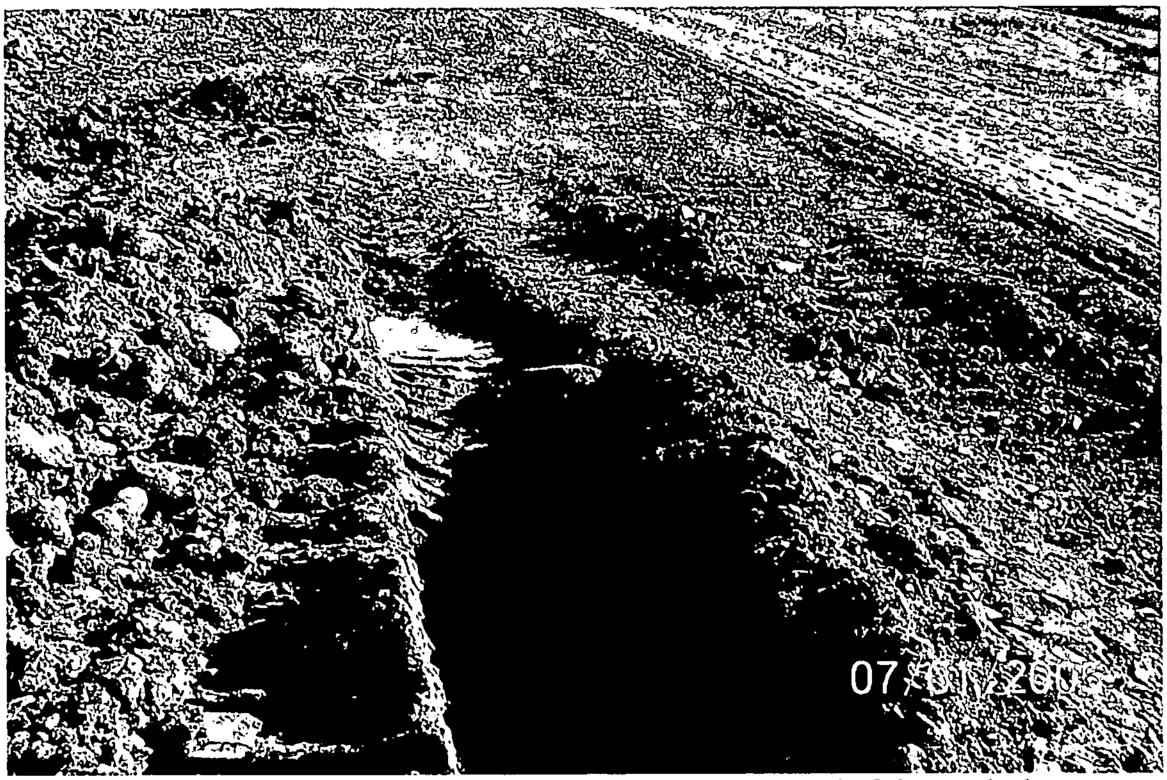

Photo 50: A view of the seep discharge point on the east end of the north slope (July 2005).

Photo 51: A view of the original French Drain discharge point into the SID east of the OLF project limits (July 2005).

Photo 52: A view of one location where the geotextile was damaged and then patched by the contractor (July 2005).

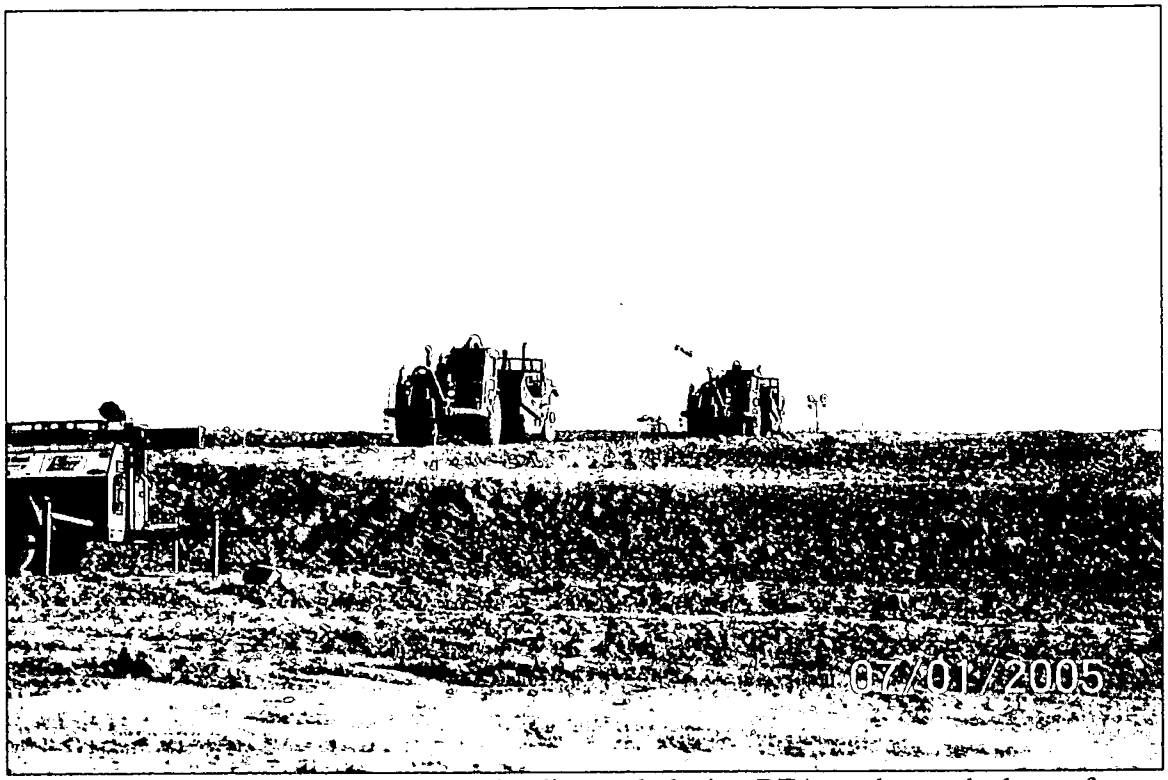

Photo 53: A view of the scrapers hauling and placing RFA on the north slope of the OLF (July 2005).

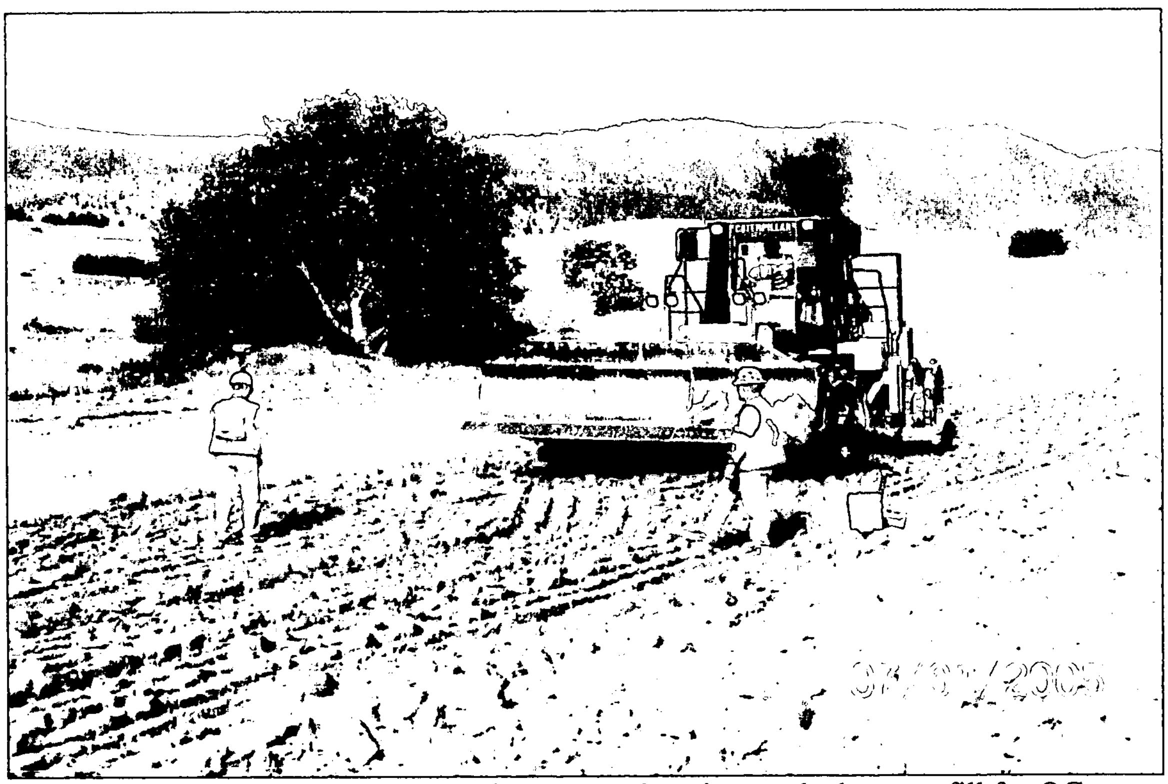

Photo 54: A view of survey locating a retest location on the buttress fill for QC (July 2005).

Photo 55: A view of the second excavation of drain rock and geotextile along the north side of the buttress (July 2005).

Photo 56: Construction of the East Subsurface Drain (ESD) (July 2005).

Photo 57: A view of the discharge point of the ESD once flow was established several days after construction of the drain (July 2005).


Photo 58: Construction of the extension of the original French drain through the east access road (Legacy Road), (July 2005).

Photo 59: A view of the abandoned natural gas line prior to removal in the eastern grade-to-drain area (July 2005).

Photo 60: A view of a D-5 Dozer ripping the buttress slope to prepare for cover fill placement (July 2005).

Photo 61: A view of the laborers installing the anchor trench for the C 125 BN temporary erosion matting upslope from Diversion Berm #1 (August 2005).

Photo 62: A view of the CAT 966 G Front end Loader spreading a thin 2" thick layer of topsoil along the West Channel bottom (August 2005).

Photo 63: A view of laborers hand broadcasting seed in the West Channel (August 2005).

Photo 64: A view of the P 550 TRM placed throughout the West Channel with C 125 BN erosion matting in the foreground protecting the exposed slope (August 2005).

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Photo 65: A view of the installation of Monitoring Well No. 80105 at the toe of the buttress (August 2005).

Photo 66: A view of Diversion Berm # 1 with the erosion matting and Georidges ® spaced every 130 feet (August 2005).

Photo 67: A view of the slope failure caused by a groundwater seep along the west side slope of the East Channel (August 2005).

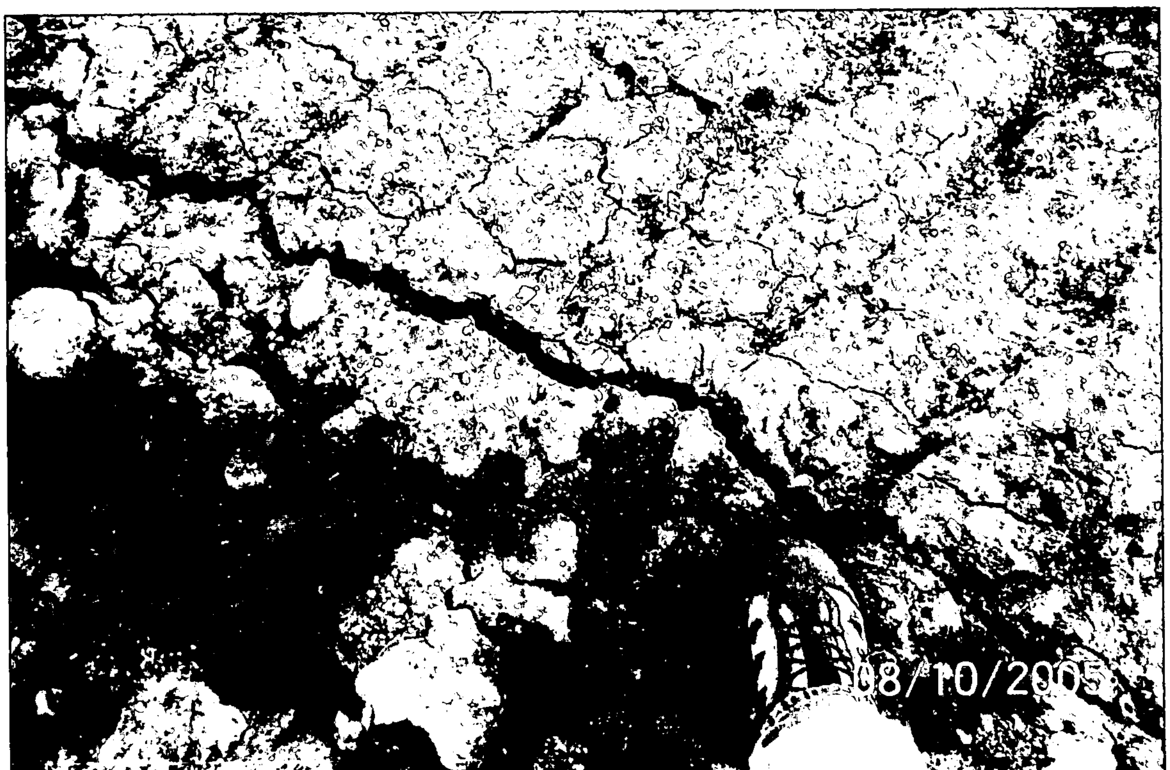

Photo 68: A view of the tension crack which developed along the east side slope of the West Channel (August 2005).

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Photo 69: A view of the over excavation of the weathered claystone on the side slope of the West Channel which is similar to the excavation performed on the East Channel side slope (August 2005).

Photo 70: A view of the excavator grading the RFA backfill placed in the excavation in the previous photo (August 2005).

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Photo 71: A view of the 6" rip rap placed in the bottom of the seep excavation in the West Channel up slope from the tension crack excavation shown in the previous two photos (August 2005).

Photo 72: A view of the 6" rip rap wrapped in geotextile placed at the bottom of the seep mitigation trench under Diversion Berm #3 (August 2005).

Photo 73: A view of the top of geotextile in the seep mitigation trench under Diversion Berm #3 (August 2005).

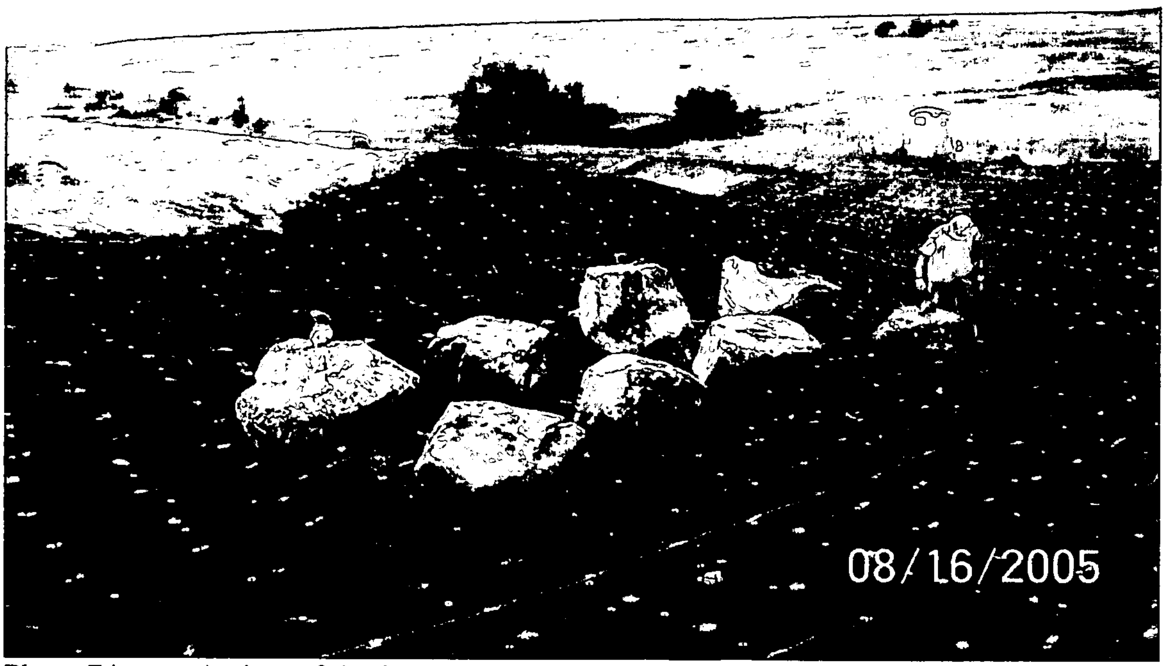

Photo 74: A view of the 24" boulders placed at the outfall of the diversion berms (August 2005).

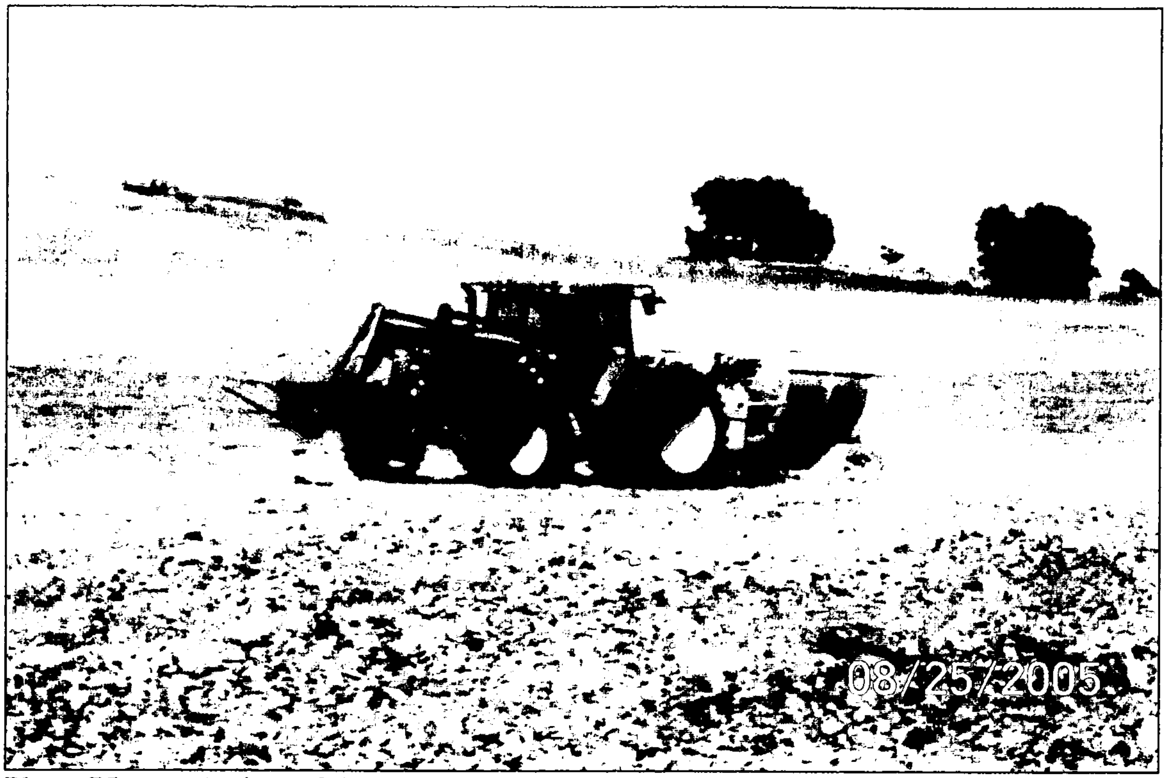

Photo 75: A view of the Hay Buster spreading the Certified Weed Free Straw along the top of the buttress (August 2005).

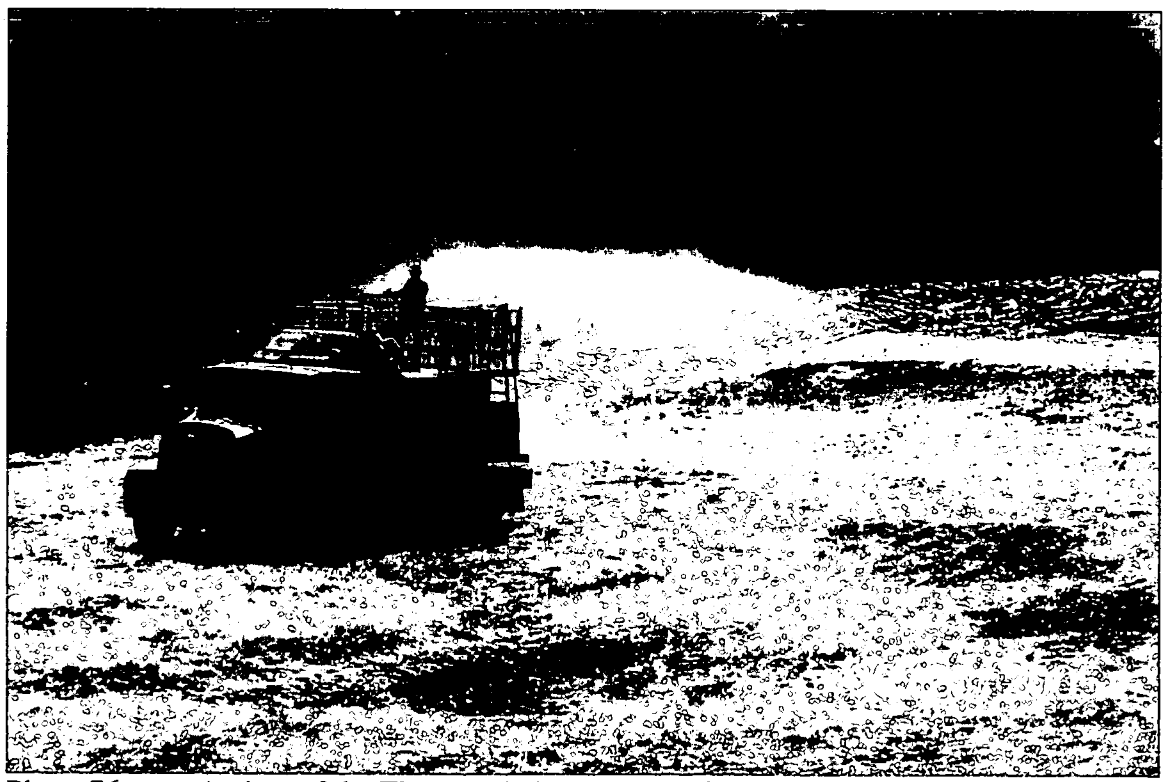

Photo 76: A view of the Flexterra being sprayed along the top of the buttress (August 2005).

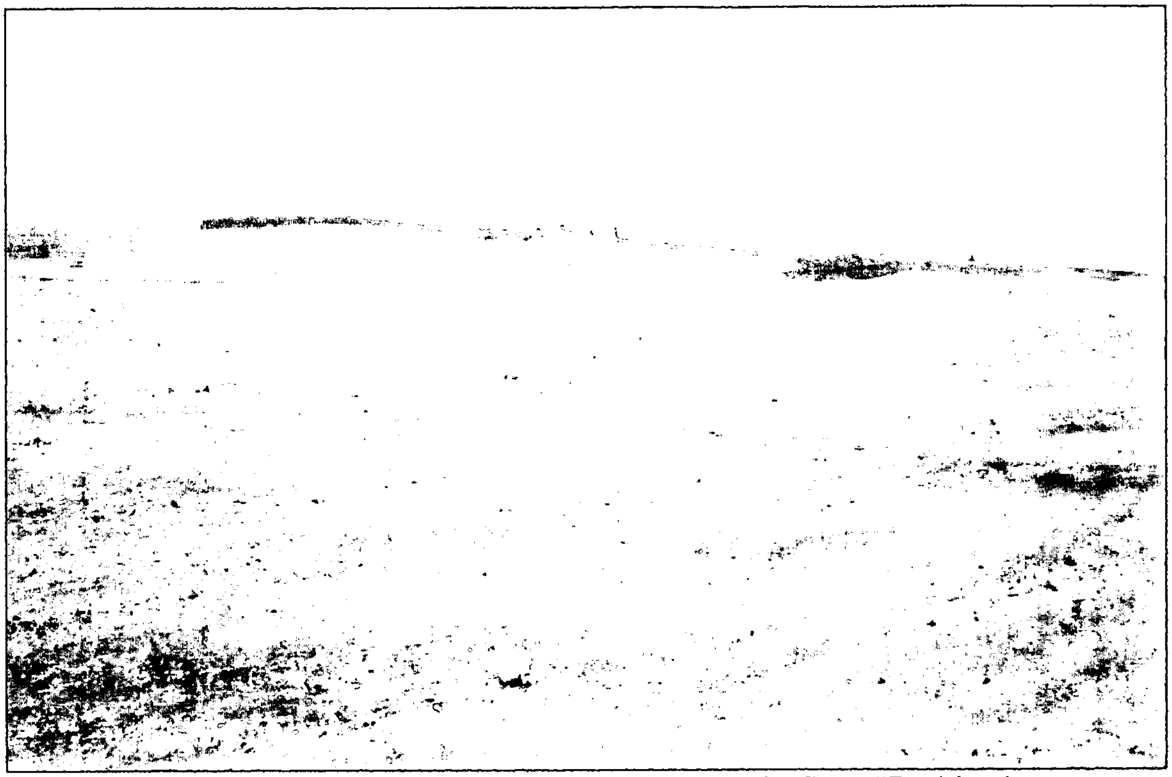

Photo 79: A view of the final revegetated cover over the Seep #7 mitigation trench. The revegetated area is the lighter brown area in the middle of the photo (September 2005).

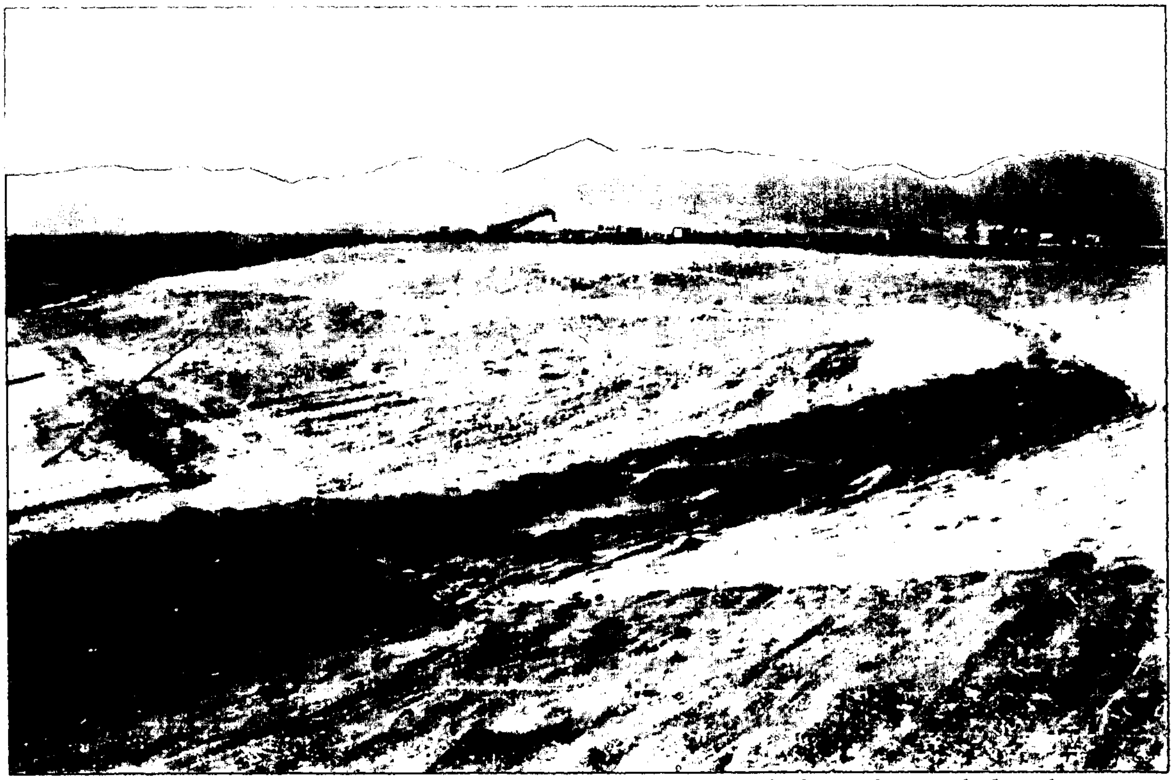

Photo 80: A view of the west end of diversion berm #4 along the grade break (September 2005).

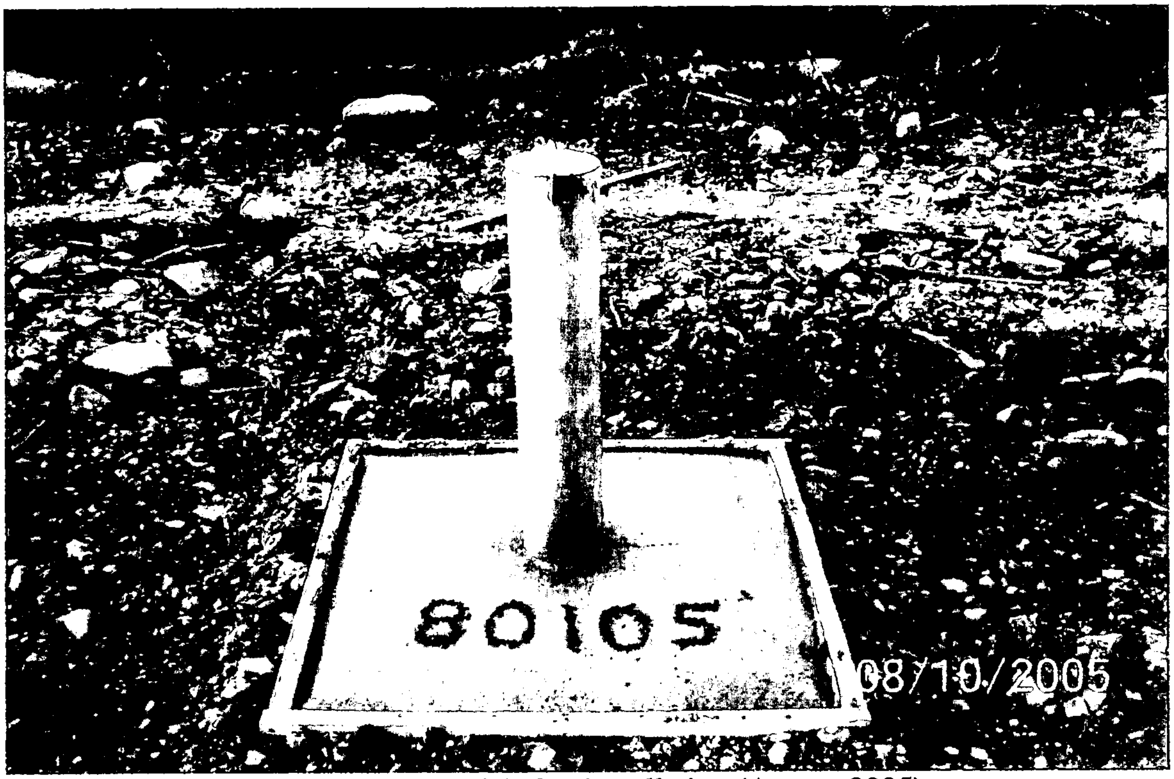

Photo 81: A view of MW # 80105 after installation (August 2005).

Photo 82: A view of the saturated soil at the toe of the 2:1 slope at the beginning of the East Channel (September 2005).

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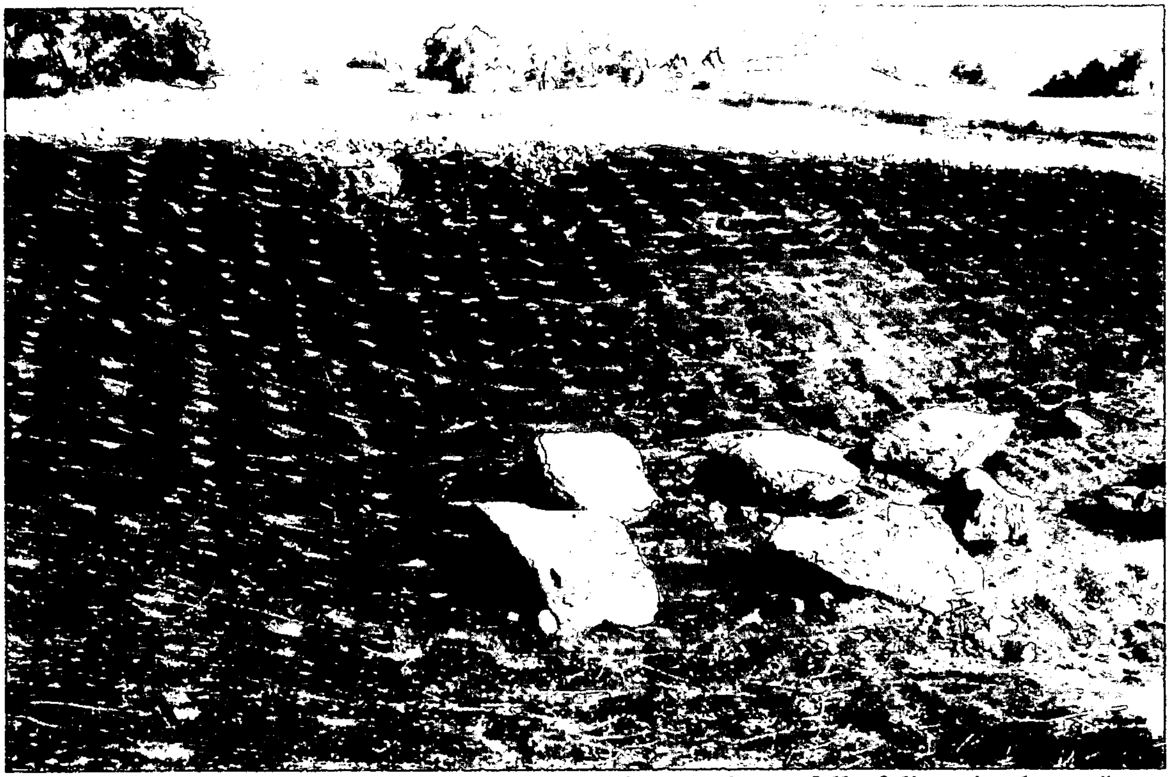

Photo 83: A view of the East Channel 2:1 slope at the outfall of diversion berm # 4. The field book from the previous photo indicating the location of the wet spot can be seen above the 24" Boulders (September 2005).

Photo 84: A view of the regraded area north of the OLF adjacent to the railroad tracks (September 2005).

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Photo 85: A easterly view along the flowline of berm #4 (September 2005).

APPENDIX D

CONSTRUCTION CONTRACTOR'S SUBMITTALS AND APPROVAL DOCUMENTATION

)5)

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SUBMITTAL REGISTER

PROJECT	Cover Original Landfill		
JOB NUMBER	T0113090	PAGE	of
LOCATION	RFETS	DATE	5-11-05

Section Description	Section No.	Para. No.	Component	Description of Item	Transmittal No.	Submittal Classification [1]	Submission Date	Approval Date	Remarks
Regrade and Cover Material	2221	1.03 A		Proposed Equipment List	OLF-001	QA	11-May-05	5-11-05	
Drain Rock	2222	1.04 A		Proposed Equipment List	OLF-002	QA	11-May-05	5-11-05	
Riprap and Riprap Bedding	2245	1.04 A		Proposed Equipment List	OLF-003	QA	11-May-05	5-11-05	
Drain Rock	2200	1.03		Supplier Sieve Analysis	OLF-004	QA	11-May-05	5-11-05	
Earthwork	2221	1.04		Location, Quanitity, and Geotechnical Date for Import Soils	OLF-005	QA	~~11-May-05~~ 27 MAY 05	5-31-05	
General Project	N/A	Table 7.1		QA/QC Resumes	OLF-006	CDPHE	11-May-05	5-17-05	
DRAIN ROCK	2200	2.01 A.		SUPPLIER SIEVE	OLF-007	QA	5-18-05	5-19-05	
GEOTEXTILE	02223	1.03		GEOTEXTILE INFORMATION	OLF-008	QA	6-6-05	6-6-05	
BUTT EARTHWORK	02200	1.03	A	LAFARGE PIT FINES	OLF-009	QA	6-21-05	6-23-05	
Geotechnical Info	02200	1.03	A	Pioneer Buttress Fill	010	QA	7-18-05	7-18-05	
Geotextile	02223	1.03		400L Rolls	011	QA	7-18-05	7-15-05	
EROSION MAT	02227	1.04		C350 AND P550 C of C	012	QA	7-19-05	7-19-05	
NAGC EROSION MAT	02227	1.04		NAGC 125 BN	013	QA	7-28-05	7-28-05	
SEEDING				SEED TAGS	014	QA	9-1-05		

[1] Submittals shall be classified as D (Designer of Record Approval), QA (CQAE Approval), or FIO (For Information Only).

053

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	TRANSMITTAL NO.: OLF-001 DATE:

To: Mike Keating (K-H) T130F Rocky Flats Environmental Technology Site 10808 HWY 93, Unit B Golden, Colorado 80403-8200	From: Steven McQueary (Envirocon) T130J Rocky Flats Environmental Technology Site 10808 HWY 93, Unit B Golden, Colorado 80403-8200	
Specification Sec. No. 02221	Project Title and Location: Cover Original Landfill - Rocky Flats	

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	Proposed Equipment List	3	1.03 A	N/A	N/A

REMARKS

Specific equipment needs may vary throughout duration of the project - this initial list of proposed equipment is acceptable. JHR/TT

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary [signature]

NAME AND SIGNATURE OF CONTRACTOR

NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE
for H. Rale CQAE Tetra Tech	5/12/05

☒ APPROVED
☐ APPROVED AS CORRECTED
☐ NOT APPROVED
☐ REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

SITE QA MANAGER / DATE

M Keating 5/11/05

RESPONSIBLE MANAGER DATE

Section Description: Regrade and Cap Material
Section Number: 02222
Paragraph Number: 1.04 A
Description of Item: Proposed Equipment List
Transmittal Number: OLF-001

Regrade and Cap Material Equipment List

- Caterpillar D10R Track Type Tractor or Similar
- Caterpillar D9R Track Type Tractor or Similar
- Caterpillar 825G Soil Compactor (2) or Equivalent
- Caterpillar 140H finish Blade or Similar
- Caterpillar D6R LGP series II Track Type Tractor or Equivalent
- Caterpillar 966G Wheel Loader or Similar
- Komatsu 420 Wheel Loader or Similar

See attachments to this document for specifications on D6 and Soil Compactors

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D6R SERIES II TRACK-TYPE TRACTORS

-- Select a Model --

D6R SERIES II

Engineered for demanding work, the D6R Series II is designed to be productive in a variety of applications. It keeps material moving with the reliability and low operating costs you expect from Caterpillar machines.

D6R SERIES II DETAILED SPECIFICATIONS

Engine

Engine Model	Cat C-9
Flywheel Power	185 hp / 138 kW
Maximum Flywheel Power	210 hp / 157 kW
Net Power - Caterpillar	185 hp / 138 kW
Net Power - ISO 9249	185 hp / 138 kW
Net Power - SAE J1349	183 hp / 136 kW
Net Power - EU 80/1269	185 hp / 138 kW
Net Power - DIN 70020	192 PS
Bore	4.4 in / 112 mm
Stroke	5.9 in / 149 mm
Displacement	537 in3 / 8.8 L

Weights

Operating Weight	40400 lb / 18322 kg
Shipping Weight	32426 lb / 14706 kg
Operating Weight - XL	41252 lb / 18709 kg
Shipping Weight - XL	33278 lb / 15092 kg
Operating Weight - XW	43888 lb / 19904 kg
Shipping Weight - XW	35374 lb / 16043 kg
Operating Weight - LGP	45086 lb / 20447 kg
Shipping Weight - LGP	37736 lb / 17114 kg

Blades

Blade Type	SU, S, A, PAT
SU-Blade Capacity	7.34 yd3 / 5.61 m3
SU-Blade Width	10.7 ft / 3260 mm
S-Blade Capacity	5.09 yd3 / 3.89 m3
S-Blade Width	11.02 ft / 3360 mm
A-Blade Capacity	4.16 yd3 / 3.18 m3
A-Blade Width	13.67 ft / 4166 mm

XL SU-Blade Capacity	7.34 yd3 / 5.61 m3
XL SU-Blade Width	10.7 ft / 3260 mm
XL A-Blade Capacity	5.14 yd3 / 3.93 m3
XL A-Blade Width	13.66 ft / 4165 mm
XL PAT-Blade Capacity	6.33 yd3 / 4.84 m3
XL PAT-Blade Width	11.88 ft / 3620 mm
XW SU-Blade Capacity	7.43 yd3 / 5.68 m3
XW SU-Blade Width	11.67 ft / 3556 mm
XW A-Blade Capacity	5.62 yd3 / 4.3 m3
XW A-Blade Width	13.78 ft / 4200 mm
XW PAT-Blade Capacity	6.65 yd3 / 5.08 m3
XW PAT-Blade Width	12.45 ft / 3794 mm
LGP S-Blade Capacity	4.84 yd3 / 3.7 m3
LGP S-Blade Width	13.09 ft / 3990 mm
LGP PAT-Blade Capacity	5.5 yd3 / 4.21 m3
LGP PAT-Blade Width	13.69 ft / 4173 mm

Engine - XL / XW / LGP

Engine Model	Cat C-9
Engine Ratings at	2000 RPM / 2000 RPM
Gross Power	213 hp / 159 kW
Flywheel Power	189 hp / 141 kW
Net Power - Caterpillar	189 hp / 141 kW
Net Power - ISO 9249	189 hp / 141 kW
Net Power - EU 80/1269	189 hp / 141 kW
Net Power - SAE J1349	187 hp / 139 kW
Net Power - DIN 70020	196 PS
Bore	4.4 in / 112 mm
Stroke	5.9 in / 149 mm
Displacement	537 in3 / 8.8 L

Transmission

1 Forward	2.4 mph / 3.8 kph
2 Forward	4.1 mph / 6.6 kph
3 Forward	7.1 mph / 11.5 kph
1 Reverse	3 mph / 4.8 kph
2 Reverse	5.2 mph / 8.4 kph
3 Reverse	9.1 mph / 14.6 kph

Undercarriage

Shoe Type	Moderate Service
Width of Shoe	22 in / 560 mm
Shoes/Side	39
Grouser Height	2.6 in / 65 mm
Pitch	8 in / 203 mm
Ground Clearance	14.8 in / 376 mm
Track Gauge	74 in / 1880 mm
Track on Ground	8.56 ft / 2610 mm

Ground Contact Area	4532 in2 / 2.92 m2
Ground Pressure	8.9 psi / 0.63 kPa
Track Rollers/Side	6

Service Refill Capacities

Fuel Tank	101 gal / 382.3 L
Cooling System	20.3 gal / 76.8 L
Engine Crankcase	7.4 gal / 28 L
Powertrain	38.5 gal / 145.7 L
Final Drives (each)	3.6 gal / 13.6 L
Roller Frames (each)	6.5 gal / 24.6 L
Pivot Shaft Compartment	0.5 gal / 1.9 L
Hydraulic Tank	12.5 gal / 47.3 L

Hydraulic Controls - Maximum Operating Pressure

Bulldozer	2799 psi / 19300 kPa
Bulldozer Tilt	2799 psi / 19300 kPa
Tilt Cylinder	2799 psi / 19300 kPa
Ripper (Lift)	2799 psi / 19300 kPa
Ripper (Pitch)	2799 psi / 19300 kPa
Steering	5511 psi / 38000 kPa

Hydraulic Controls - Pump

Pump Capacity at	1001 psi / 6900 kPa
RPM at Rated Engine Speed	2125 RPM / RPM
Pump Output (Clutch Brake)	56 gal/min / 212 L/min
Pump Output (Differential Steering)	57.3 gal/min / 217 L/min
Lift Cylinder Flow	50.2 gal/min / 190 L/min
Tilt Cylinder Flow	21.1 gal/min / 80 L/min
Ripper Cylinder Flow	42.3 gal/min / 160 L/min

Hydraulic Controls - Main Relief Valve Settings

Clutch Brake Models	2799 psi / 19300 kPa
Differential Steering Models	6092 psi / 42000 kPa

Winch

Winch Model	PA 56
Weight*	2600 lb / 1179 kg
Oil Capacity	17.7 gal / 67 L
Winch and Bracket Length	47.6 in / 1210 mm
Winch Case Length	47.6 in / 1210 mm
Winch Case Width	38.4 in / 975 mm
Increased Tractor Length - STD	20.4 in / 517 mm
Increased Tractor Length - XL	20.4 in / 517 mm
Increased Tractor Length - XR	20.4 in / 517 mm
Increased Tractor Length - LGP	15.6 in / 397 mm
Drum Diameter	10 in / 254 mm

Drum Width	13 in / 330 mm
Flange Diameter	19.8 in / 504 mm
Drum Capacity - 22 mm (.88 in)	290 ft / 88 m
Drum Capacity - 25 mm (1.0 in)	220 ft / 67 m
Drum Capacity - 29 mm (1.13 in)	220 ft / 67 m
Ferrule Size (O.D. X Length)	54 x 67 mm 2.13 in x 2.64 in

Dimensions

Overall Length Basic Tractor (with Drawbar)	12.66 ft / 3.86 m

Ripper

Type	Fixed Parallelogram
Number of Pockets	3
Overall Beam Width	87 in / 2202 mm
Beam Cross Section	216 x 254 mm 8.5 x 10.0 in
Maximum Clearance Raised (under tip, pinned in bottom hole)	20.1 in / 511 mm
Maximum Penetration	19.7 in / 500 mm
Maximum Penetration Force	14557 lb / 6603 kg
Pryout Force	20137 lb / 9134 kg
Weight - With One Shank	3603 lb / 1634 kg
Each Additional Shank	163 lb / 74 kg

Standards

ROPS/FOPS

Cab

Brakes

Soil Compactors | Specifications


MODEL	815F		825G Series II	
Flywheel Power	179 kW	240 hp	253 kW	339 hp
Operating Weight*	20 755 kg	45,765 lb	32 734 kg	72,164 lb
Engine Model	3176C ATAAC		3406E ATAAC	
Rated Engine RPM	2100		2000	
No. Cylinders	6		6	
Displacement	10.3 L	629 in³	14.6 L	893 in³
Speeds:				
Forward	3		3	
Reverse	3		3	
Turning Radius — outside Corner of Blade	7.2 m	23'7"	7.4 m	24'0"
Fuel Tank Refill Capacity	446 L	117.8 U.S. gal	608 L	161 U.S. gal
TAMPING FOOT WHEELS:				
Each Drum Width	991 mm	3'3"	1125 mm	3'8"
Diameters, over feet	1.42 m	4'8"	1.68 m	5'5"
over drum	1.03 m	3'5"	1.29 m	4'3"
Feet per Wheel	60		65	
Feet per Row	12		13	
Rows of Feet	5		5	
Foot Length	191 mm	7.5"	188 mm	7.4"
End Area Per Foot	134 cm²	20.8 in²	192 cm²	29.75 in²
Width of Two Pass Coverage	4.2 m	13'9"	5.3 m	17'4"
GENERAL DIMENSIONS:				
Height (top of ROPS)	3.34 m	11'0"	3.74 m	12'3"
Height (stripped top)**	2.39 m	7'10"	2.65 m	8'8"
Wheel Base	3.35 m	11'0"	3.7 m	12'1"
Overall Length with Dozer	6.80 m	23'6"	8.24 m	27'5"
Width over Drums	3.24 m	10'8"	3.65 m	12'0"
Ground Clearance	390 mm	15.4"	596 mm	23"
STRAIGHT BULLDOZER:				
Width over End Bits	3.76 m	12'4"	4.62 m	15'1"
Height with Cutting Edge	860 mm	2'10"	1.03 m	3'4"

*Operating Weight includes coolant, lubricants, bulldozer, hydraulics, ROPS canopy, full fuel tank and operator.
**Height (stripped top) — without ROPS, exhaust, seat back or other easily removed encumbrances.

STEVE

TOTAL P.01

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TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE		TRANSMITTAL NO.: OLF-002 DATE:
To: Mike Keating (K-H) T130F Rocky Flats Environmental Technology Site 10808 HWY 93, Unit B Golden, Colorado 80403-8200	**From:** Steven McQueary (Envirocon) T130J Rocky Flats Environmental Technology Site 10808 HWY 93, Unit B Golden, Colorado 80403-8200	
Specification Sec. No. 02222	**Project Title and Location:** Cover Original Landfill - Rocky Flats	

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	Proposed Equipment List	3	1.04 A	N/A	N/A

REMARKS Suggest ~~use of~~ consideration of smooth drum roller with vibratory mode for drain rock otherwise OK J.H. Rale CQAE/TA 5/12/05

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary

NAME AND SIGNATURE OF CONTRACTOR

- [x] APPROVED
- [ ] APPROVED AS CORRECTED
- [ ] NOT APPROVED
- [ ] REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

SITE QA MANAGER / DATE

J M Keating 5/11/05

RESPONSIBLE MANAGER DATE

AUTHORITY	DATE

Section Description: Drain Rock
Section Number: 02222
Paragraph Number: 1.04 A
Description of Item: Proposed Equipment List

Drain Rock Equipment List

- Caterpillar 815F soil compactor (2)
- John Deere 450LC track type excavator
- Caterpillar 345 series II track type excavator
- Caterpillar 966G wheel loader
- Komatsu 420 wheel loader

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TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	**TRANSMITTAL NO.: OLF-003** **DATE:**

To: Mike Keating (K-H) T130F Rocky Flats Environmental Technology Site 10808 HWY 93, Unit B Golden, Colorado 80403-8200	**From:** Steven McQueary (Envirocon) T130J Rocky Flats Environmental Technology Site 10808 HWY 93, Unit B Golden, Colorado 80403-8200	
Specification Sec. No. 02245	**Project Title and Location:** Cover Original Landfill - Rocky Flats	

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	Proposed Equipment List	3	1.04 A	N/A	N/A

REMARKS

OK CQAE
JHRaba Tetra Tech 5/12/05

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary [signature]
NAME AND SIGNATURE OF CONTRACTOR

- [x] APPROVED
- [ ] APPROVED AS CORRECTED
- [ ] NOT APPROVED
- [ ] REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

SITE QA MANAGER / DATE

JM Keating 5/11/05

RESPONSIBLE MANAGER DATE

...G AUTHORITY	DATE

Section Description: Riprap and Riprap Bedding
Section Number: 02245
Paragraph Number: 1.04 A
Description of Item: Proposed Equipment List
Transmittal Number: OLF-003

Riprap and Riprap Bedding

- Caterpillar 140H finish Blade or Similar
- Caterpillar 966G Wheel Loader or Similar
- Komatsu 420 Wheel Loader or Similar
- John Deere 450LC track type excavator or Similar
- Caterpillar 345 series II track type excavator or Similar

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	**TRANSMITTAL NO.: OLF-004** **DATE:**

To: Mike Keating (K-H) T130F Rocky Flats Environmental Technology Site 10808 HWY 93, Unit B Golden, Colorado 80403-8200	**From:** Steven McQueary (Envirocon) T130J Rocky Flats Environmental Technology Site 10808 HWY 93, Unit B Golden, Colorado 80403-8200	
Specification Sec. No. 02222	**Project Title and Location:** Cover Original Landfill - Rocky Flats	

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	Supplier Sieve Analysis for Drain Rock	3	~~1.03~~ 2.0 A.1	N/A	N/A

REMARKS

GSA OK CQAE – (will also need LA Abr, Abs. & Sod. Sulf. tests – QC)
5/12/05

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary
NAME AND SIGNATURE OF CONTRACTOR

- ☐ APPROVED
- ☒ APPROVED AS CORRECTED
- ☐ NOT APPROVED
- ☐ REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications

SITE QA MANAGER / DATE

RESPONSIBLE MANAGER DATE 5/11/05

G AUTHORITY	DATE

CENTENNIAL AGGREGATES

SIEVE ANALYSIS

Product Name : Unwashed Aggregate 1.5"

Plant / Supplier / Location : Centennial Pit / Hwy 93

Sample ID No.: 79 Date Sampled: 5/3/2005

Test Procedures : ASTM C136, C702, D75 Tested By : Jesse Mohler

Sample Dry Weight (g) : 20112.0

Sieve Size	Weight, (g) Retained Cummulative	Percent, % Retained Cummulative	Results Percent % Passing Cummulative	Specs CDOT No.4 SPEC 02222	
3"					
2"	0.0	0.0	**100**	100	
1 1/2"	808.9	4.0	**96**	90-100	
1"	8995.5	44.7	**55**	20-55	
3/4"	17963.2	89.3	**11**	0-15	
1/2"	19122.5	95.1	**5**		
3/8"	19254.6	95.7	**4**	0-5	
#4	19275.2	95.8	**4**		
#8					
#10					
#16					
#30					
#40					
#50					
#80					
#100					
#200					
PAN					

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1964

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	**TRANSMITTAL NO.:** OCF-005 **DATE:** 5-27-05
To: MIKE KEATING (KH) T130F RFETS HWY 93, UNIT B, GOLDEN CO 80403	**From:** STEVEN McQUEARY (CENTIROCON) T130J RFETS 10808 HWY 93, UNIT B, GOLDEN, CO 80403
Specification Sec. No. 02221	**Project Title and Location:** COVER ORIGINAL LANDFILL

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	LOCATION, QUANTITY & GEOTECHNICAL DATA FOR IMPORT SOILS	3	1.04	N/A	N/A

REMARKS

CENTENNIAL AGGREGATES WILL SUPPLY APPROXIMATELY 20% OF PIT FINES. ADDITIONAL SUBMITTAL WILL FOLLOW ONCE OTHER SOURCE IDENTIFIED

Gradations don't meet specs. (02221, 3.06 A.5); Therefore strength strength tests req'd. for pit fines & perm. tests for drain rock

ECRs Req'd. for both J.H. Rale CQAE TA

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

STEVEN McQUEARY [signature]

NAME AND SIGNATURE OF CONTRACTOR

- [x] APPROVED
- [ ] APPROVED AS CORRECTED
- [ ] NOT APPROVED
- [ ] REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

SITE QA MANAGER / DATE

J M Keating 5/31/05

RESPONSIBLE MANAGER DATE

G AUTHORITY	DATE

Section Description: Earthwork
Section Number: SPEC-02221-0983
Paragraph Number: 1.04
Description of Item: Location, Quantity and Geotechnical Data for Import Soils
Transmittal Number: OLF-005

Buttress Fill Material (Pit Fines)

Location 1: Centennial Aggregates, 10860 Hwy. 93 Golden, Co. 80401
Quantity: 52,000 Bank Cubic Yards, Per table 7.2 in the Construction Quality Assurance/Quality Control Plan
Geotechnical Data: See Attached

Diversion Berms (Rocky Flats Alluvium)

Location: Centennial Aggregates, 10860 Hwy. 93 Golden, Co. 80401
Quantity: 5,900 Bank Cubic Yards, Per table 7.2 in the Construction Quality Assurance/Quality Control Plan
Geotechnical Data: See Attached

Re-grade Material (Rocky Flats Alluvium)

Location: Centennial Aggregates, 10860 Hwy. 93 Golden, Co. 80401
Location 2: Pioneer Sand and Gravel, 7608 Hwy. 93 Golden, Co. 80403
Quantity: 45,000 Bank Cubic Yards, Per table 7.2 in the Construction Quality Assurance/Quality Control Plan
Geotechnical Data: See Attached

Soil Cover Material (Rocky Flats Alluvium)

Location: Centennial Aggregates, 10860 Hwy. 93 Golden, Co. 80401
Quantity: 39,000 Bank Cubic Yards, Per table 7.2 in the Construction Quality Assurance/Quality Control Plan
Geotechnical Data: See Attached

Drain Rock

Location: Centennial Aggregates, 10860 Hwy. 93 Golden, Co. 80401
Quantity: 9,000 Bank Cubic Yards, Per table 7.2 in the Construction Quality Assurance/Quality Control Plan
Geotechnical Data: See Attached

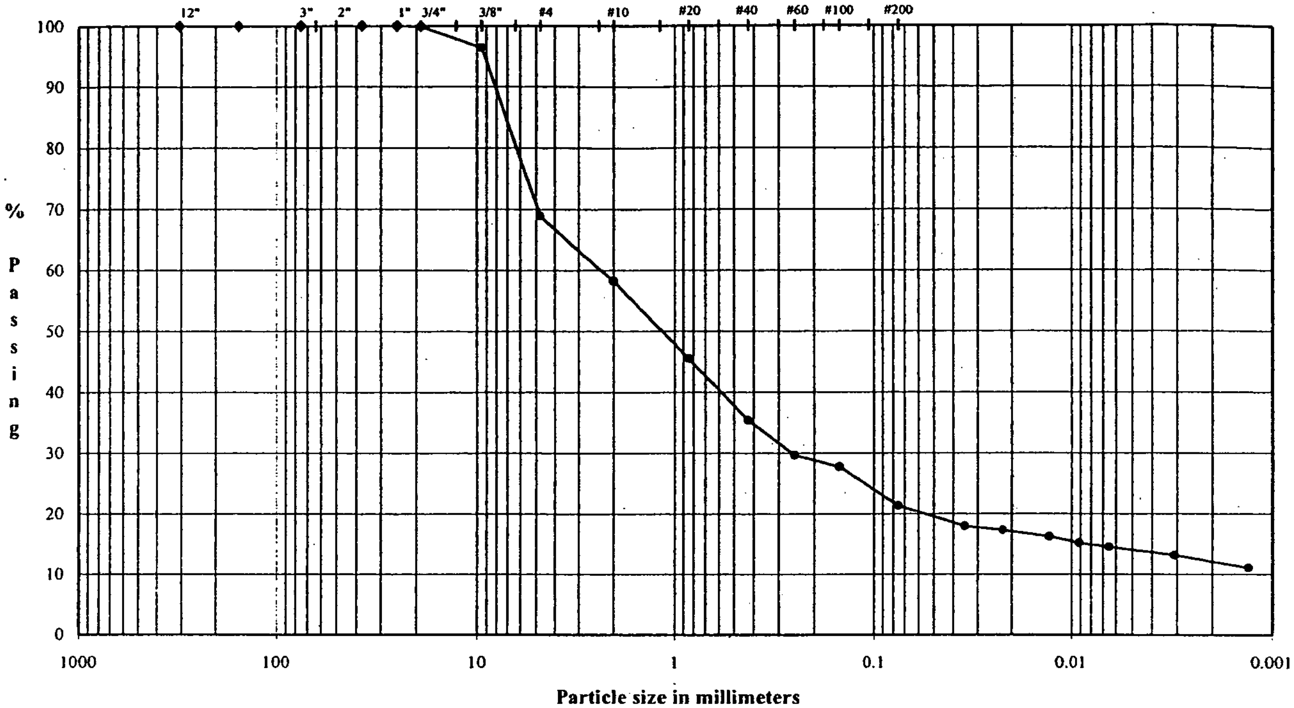
CENTENNIAL AGGREGATES PIT FINES

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

Centennial Pit Fines

PROJECT NAME:	Kaiser Hill/Rocky Flats Field & Lab		
SAMPLE ID:	CPF-2	Depth (ft):	-
TYPE:	Pail		



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

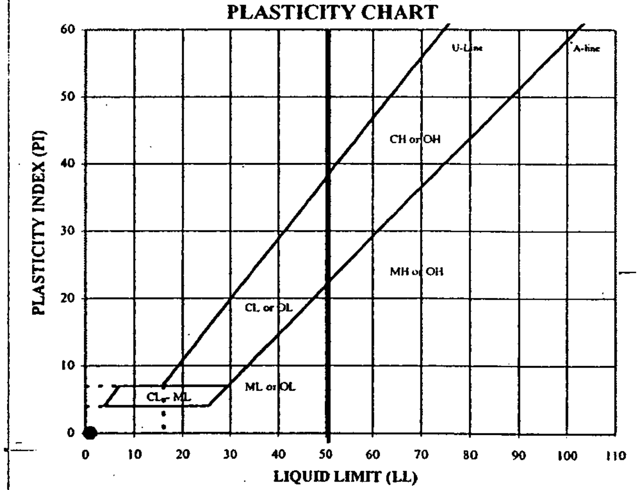
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	0.10
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	99.9	Fine Gravel	30.99
0.375"	9.5	96.4		
#4	4.8	68.9		
#10	2.00	58.2	Coarse Sand	10.71
#20	0.85	45.5	Medium Sand	22.80
#40	0.43	35.4		
#60	0.25	29.7	Fine Sand	14.09
#100	0.15	27.7		
#200	0.075	21.3		

Hydrometer Analysis

(mm)	%Finer		
0.035	18.0	Fines Silt or Clay	21.32
0.022	17.3		
0.013	16.2		
0.0091	15.2		
0.0065	14.5		
0.0031	13.1		
0.0013	11.1		

PLASTICITY CHART



ATTERBERG LIMITS

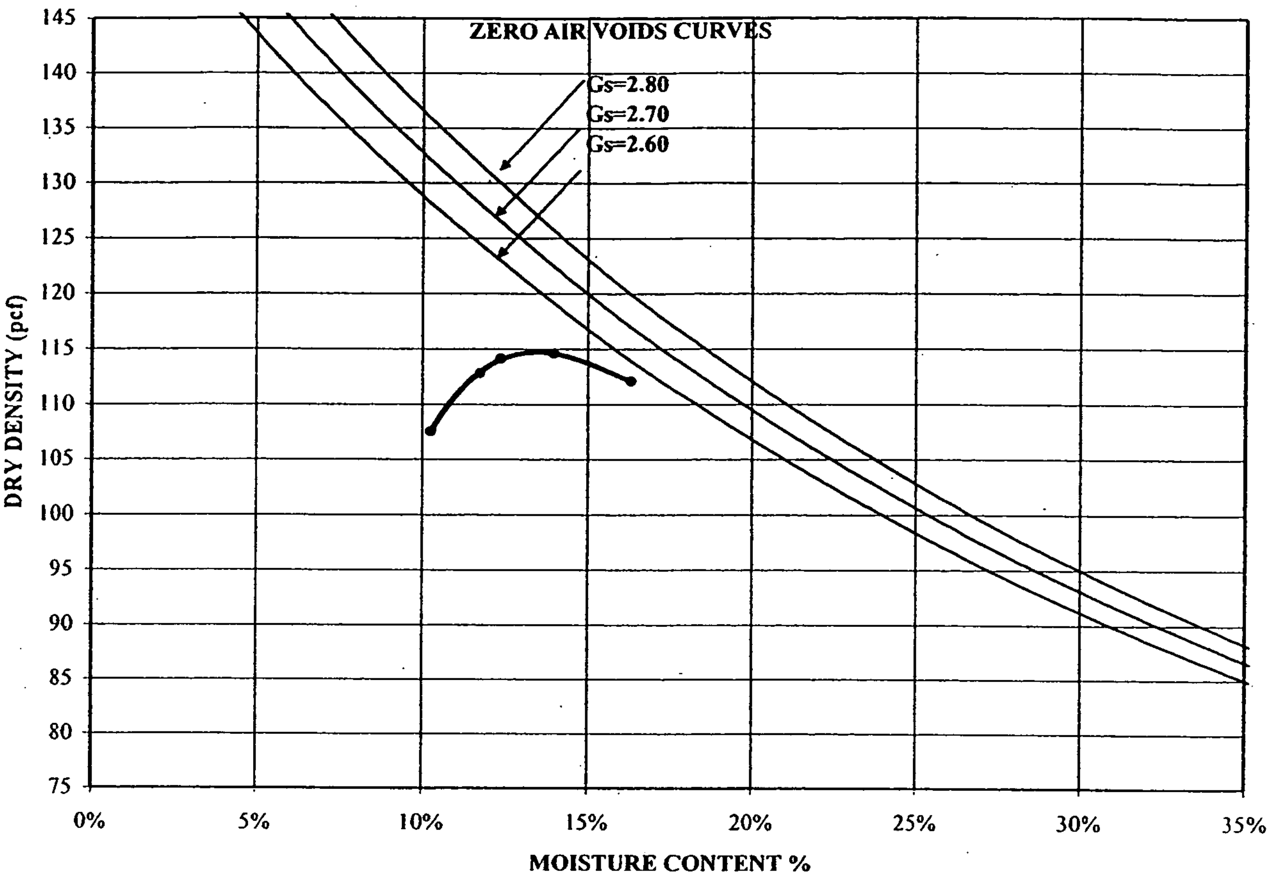
M_c	LL	PL	PI	SpG
--	--	--	--	--

DESCRIPTION: Moderate yellowish brown

USCS: --

TECH	DS
DATE	5/12/2005
REVIEW	MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD B



MAXIMUM DRY DENSITY (pcf)	114.8	Corrected Maximum Dry Density (pcf)
OPTIMUM MOISTURE (%)	13.7	Corrected Optimum Moisture (%)

SAMPLE ID	CPF-2
SAMPLE TYPE	Pail
SAMPLE DEPTH	-

LL	--
PL	--
PI	--
MC	--

DESCRIPTION	Moderate yellowish brown
USCS	--

Kaiser Hill/Rocky Flats Field & Lab
053-2203-0001

TECH	MKS
DATE	5-11-05
REVIEW	MB

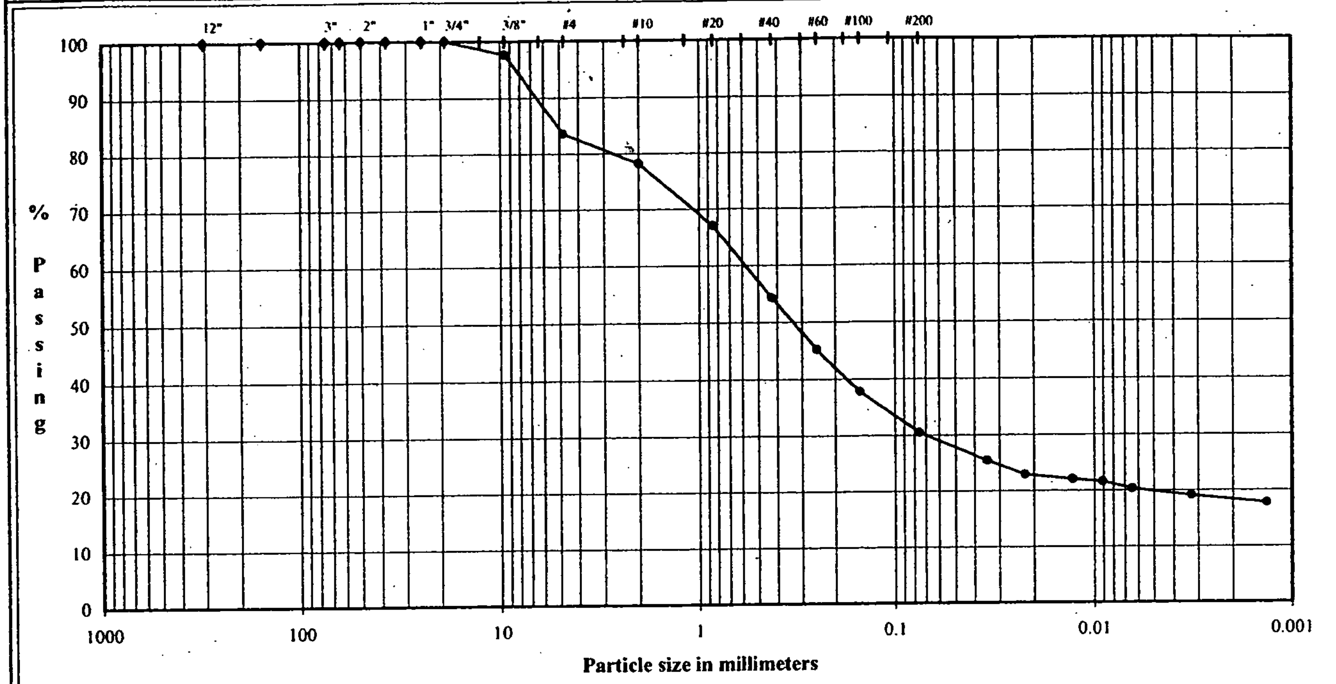
PF = Pit Fines

July-04 043-2246.0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME:	Rocky Flats/Field & Lab Testing/CO		
SAMPLE ID:	PF-1	Depth (ft):	-
TYPE:	BULK		



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

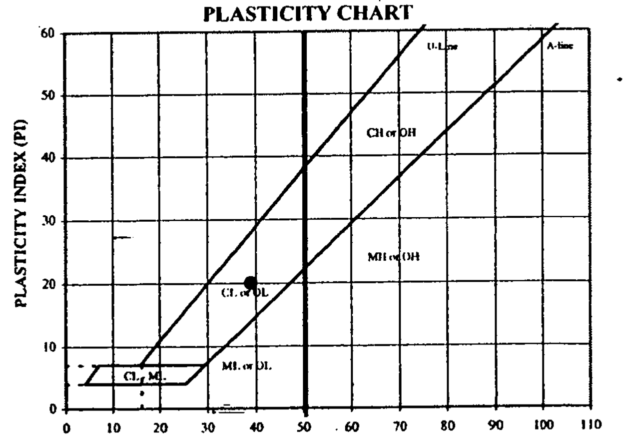
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0	Coarse Gravel	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Fine Gravel	16.46
0.375"	9.5	97.7		
#4	4.8	83.5		
#10	2.00	78.2	Coarse Sand	5.37
#20	0.85	67.0	Medium Sand	23.88
#40	0.43	54.3		
#60	0.25	45.1	Fine Sand	23.85
#100	0.15	37.7		
#200	0.075	30.4		

Hydrometer Analysis

(mm)	%Finer		
0.034	25.4	Fines Silt or Clay	30.44
0.022	22.8		
0.013	22.0		
0.0091	21.6		
0.0064	20.3		
0.0032	19.0		
0.0013	17.8		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
16.1	39	19	20	

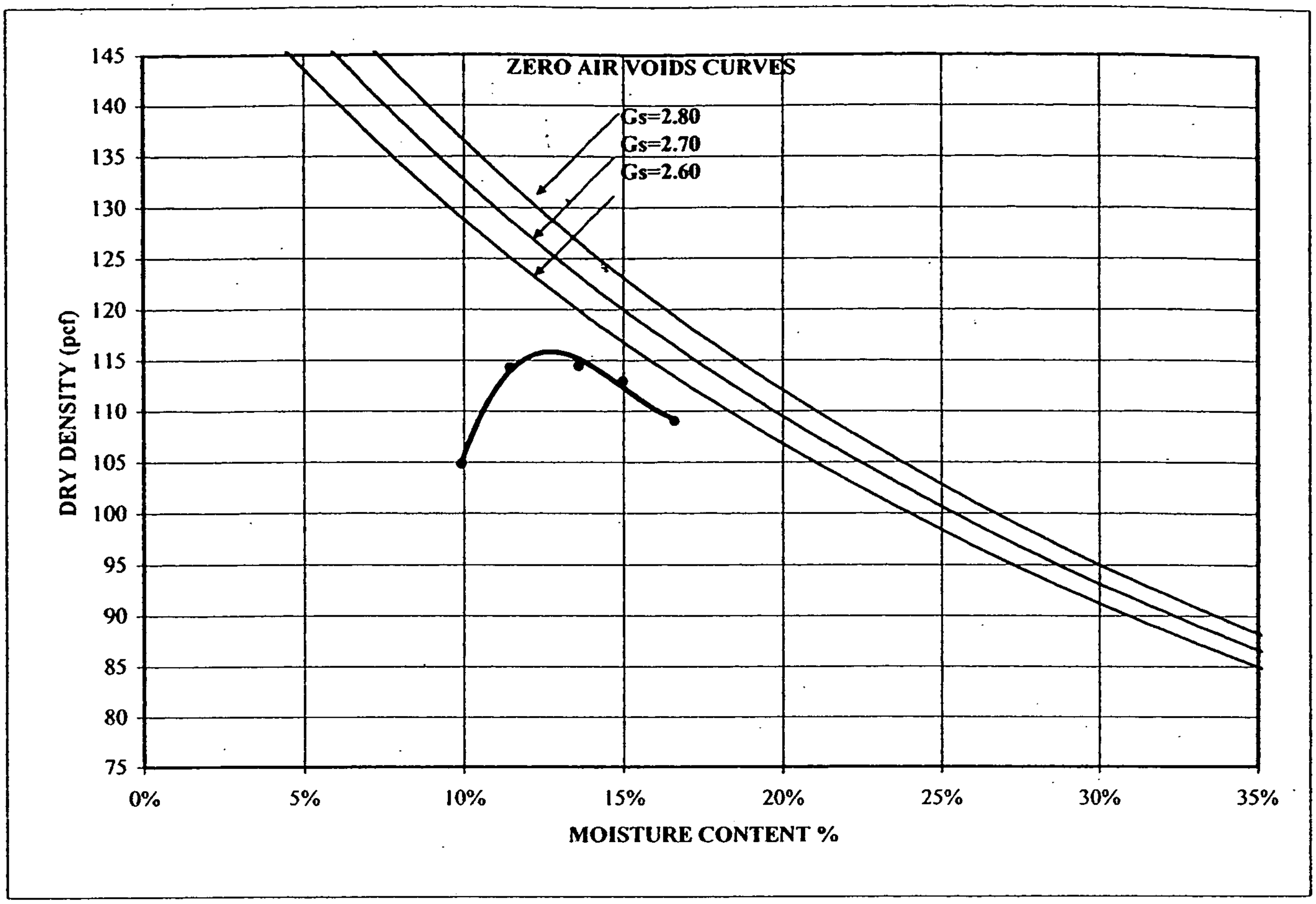
DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand with gravel

USCS: SC

TECH	JR
DATE	7/15/2004
REVIEW	NG

Golder Associates Inc.

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	115.8	Corrected Maximum Dry Density (pcf)	120.6
OPTIMUM MOISTURE (%)	12.7	Corrected Optimum Moisture (%)	10.7

SAMPLE ID	PF-1
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

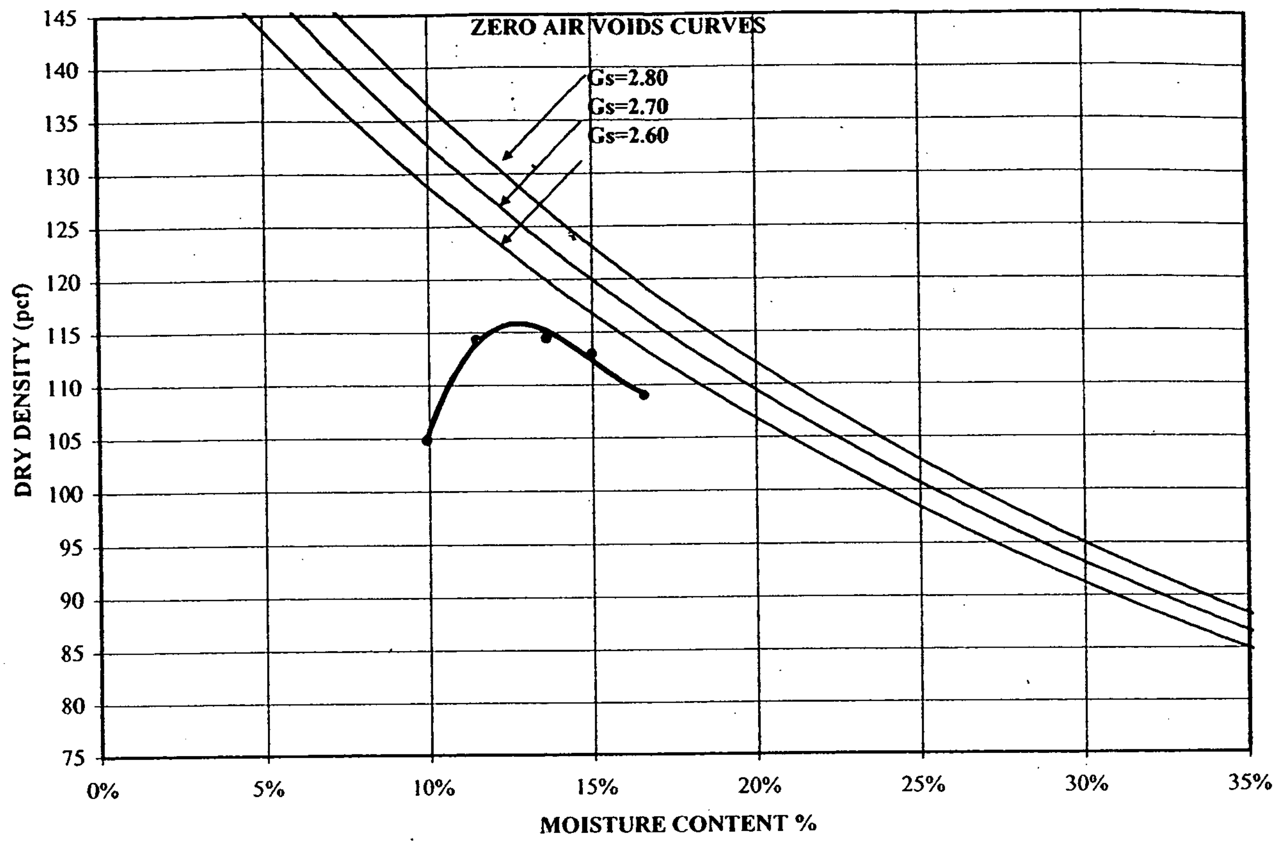
LL	39
PL	19
PI	20
MC	16.1%

DESCRIPTION	Yellowish brown (10 YR 5/8) clayey sand with gravel
USCS	SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	DT
DATE	7/16/04
REVIEW	NG

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	115.8	Corrected Maximum Dry Density (pcf)	120.6
OPTIMUM MOISTURE (%)	12.7	Corrected Optimum Moisture (%)	10.7

SAMPLE ID	PF-1
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	39
PL	19
PI	20
MC	16.1%

DESCRIPTION	Yellowish brown (10 YR 5/8) clayey sand with gravel
USCS	SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	DT
DATE	7/16/04
REVIEW	NG

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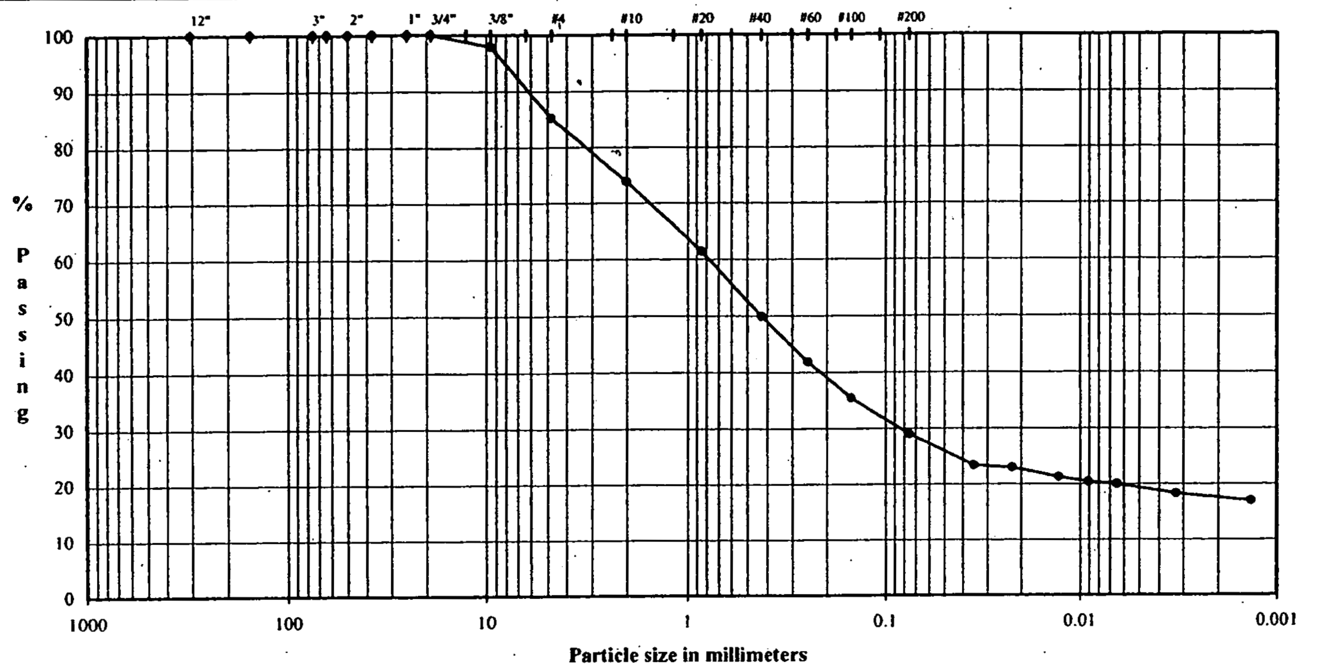
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO
SAMPLE ID: PF-2 Depth (ft): -
TYPE: BULK



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

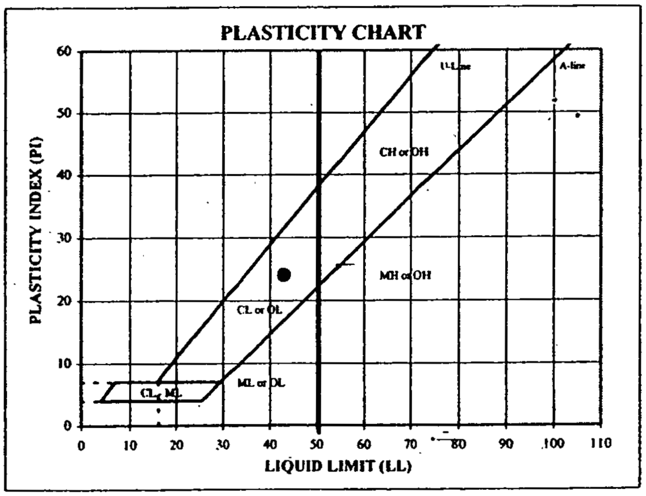
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0	Coarse Gravel	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0		
0.375"	9.5	97.9	Fine Gravel	14.78
#4	4.8	85.2		
#10	2.00	73.8	Coarse Sand	11.45
#20	0.85	61.4	Medium Sand	23.86
#40	0.43	49.9		
#60	0.25	41.8	Fine Sand	21.03
#100	0.15	35.4		
#200	0.075	28.9		

Hydrometer Analysis

(mm)	%Finer	Classification	Percentage
0.035	23.3	Fines Silt or Clay	28.88
0.022	22.9		
0.013	21.2		
0.0091	20.4		
0.0065	19.9		
0.0033	18.2		
0.0014	17.0		

PLASTICITY CHART



ATTERBERG LIMITS

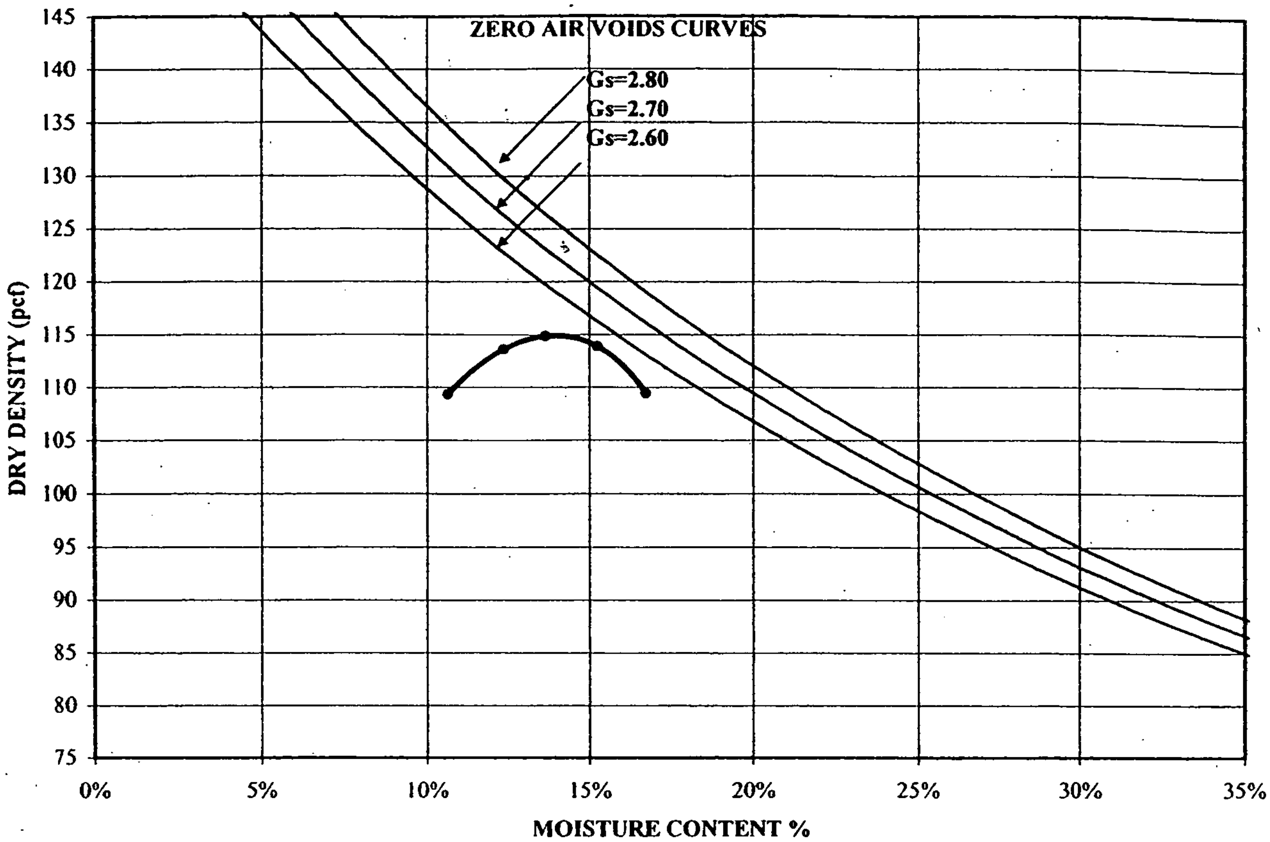
M_c	LL	PL	PI	SpG
10.3	43	19	24	

DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand

USCS: SC

TECH	DT
DATE	7/21/2004
REVIEW	MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	114.9	Corrected Maximum Dry Density (pcf)	119.9
OPTIMUM MOISTURE (%)	13.9	Corrected Optimum Moisture (%)	11.7

SAMPLE ID	PF-2
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	43
PL	19
PI	24
MC	10.3

DESCRIPTION Yellowish brown (10 YR 5/8) clayey sand

USCS SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	DT
DATE	7-22-04
REVIEW	MB

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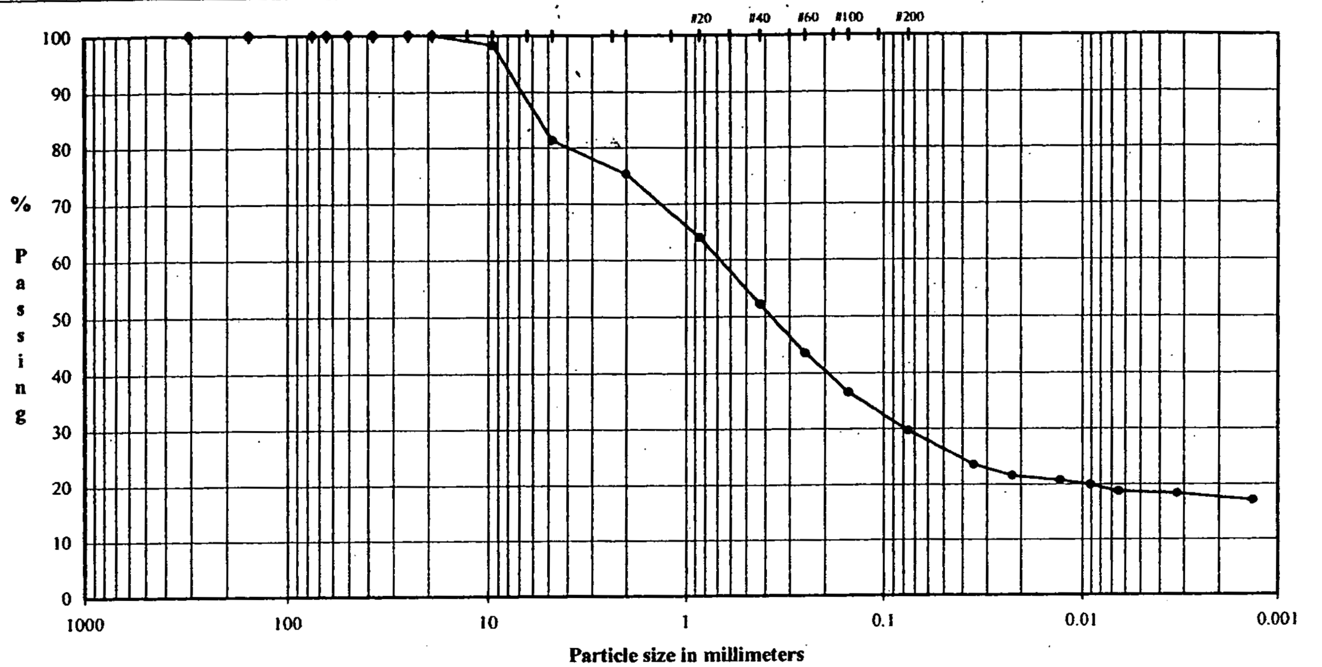
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO
SAMPLE ID: PF-3 Depth (ft): -
TYPE: BULK



COBBLES	GRAVEL: Coarse	GRAVEL: Fine	SAND: Coarse	SAND: Medium	SAND: Fine	FINES: Silt or Clay

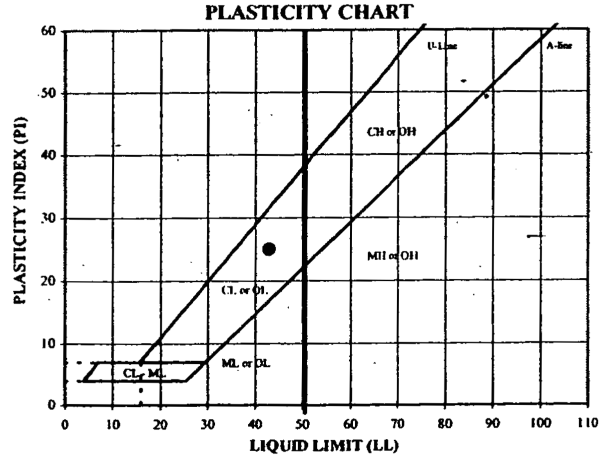
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	100.0		
6.0"	154.2	100.0	Cobbles	0.00
3.0"	75.0	100.0		
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0	Coarse Gravel	0.00
0.75"	19.0	100.0		
0.375"	9.5	98.3		
#4	4.8	81.2	Fine Gravel	18.76
#10	2.00	75.2	Coarse Sand	6.03
#20	0.85	64.0		
#40	0.43	52.1	Medium Sand	23.07
#60	0.25	43.5		
#100	0.15	36.5		
#200	0.075	29.6	Fine Sand	22.53

Hydrometer Analysis

(mm)	%Finer		
0.035	23.5		
0.022	21.5		
0.013	20.7		
0.0091	19.9	Fines Silt or Clay	29.62
0.0065	18.7		
0.0032	18.3		
0.0013	17.0		

PLASTICITY CHART



ATTERBERG LIMITS

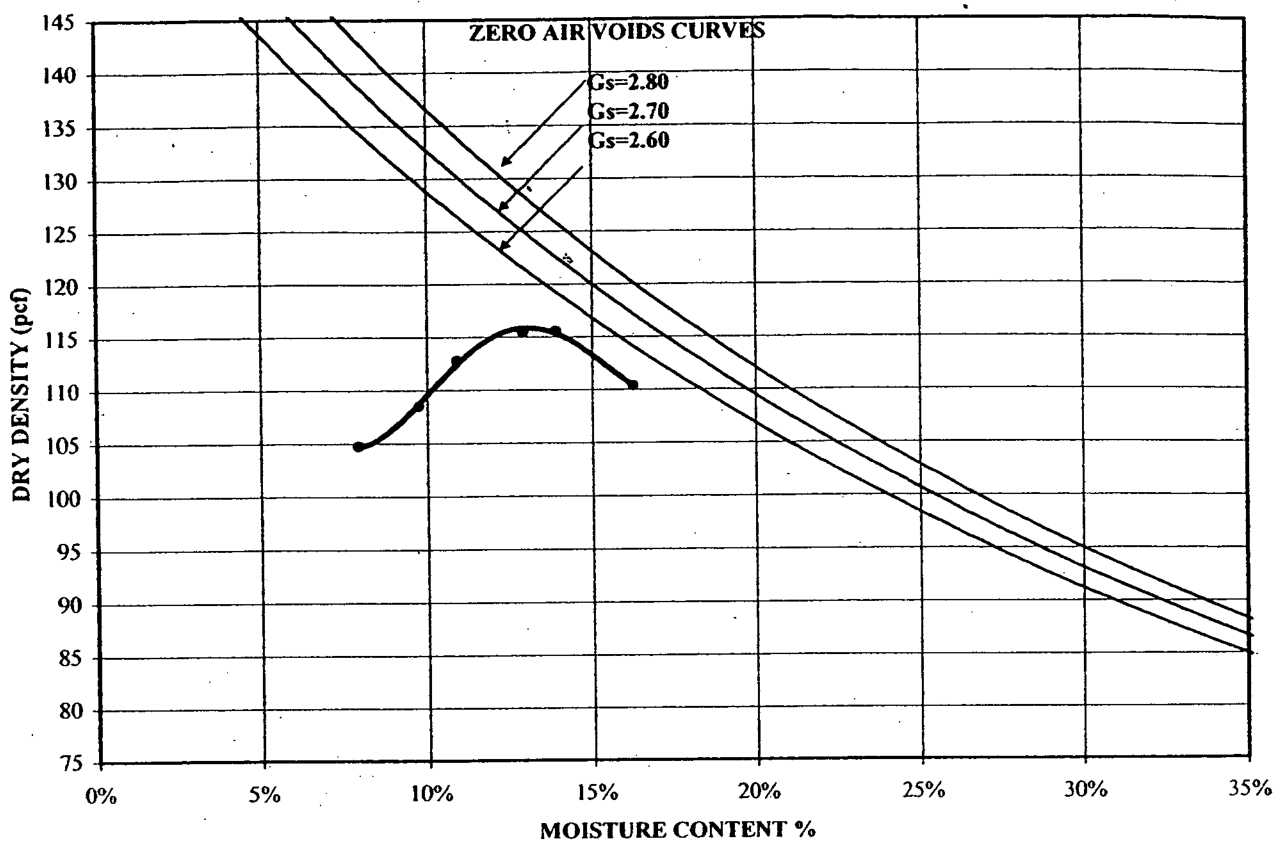
M_c	LL	PL	PI	SpG
18.1	43	18	25	–

DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand with gravel

USCS: SC

TECH	JR
DATE	7/15/2004
REVIEW	NG

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	115.5	Corrected Maximum Dry Density (pcf)	121.0
OPTIMUM MOISTURE (%)	13.2	Corrected Optimum Moisture (%)	10.9

SAMPLE ID	PF-3
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	43
PL	18
PI	25
MC	18.1%

DESCRIPTION	Yellowish brown (10 YR 5/8) clayey sand with gravel
USCS	SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	DT
DATE	7/16/04
REVIEW	NG

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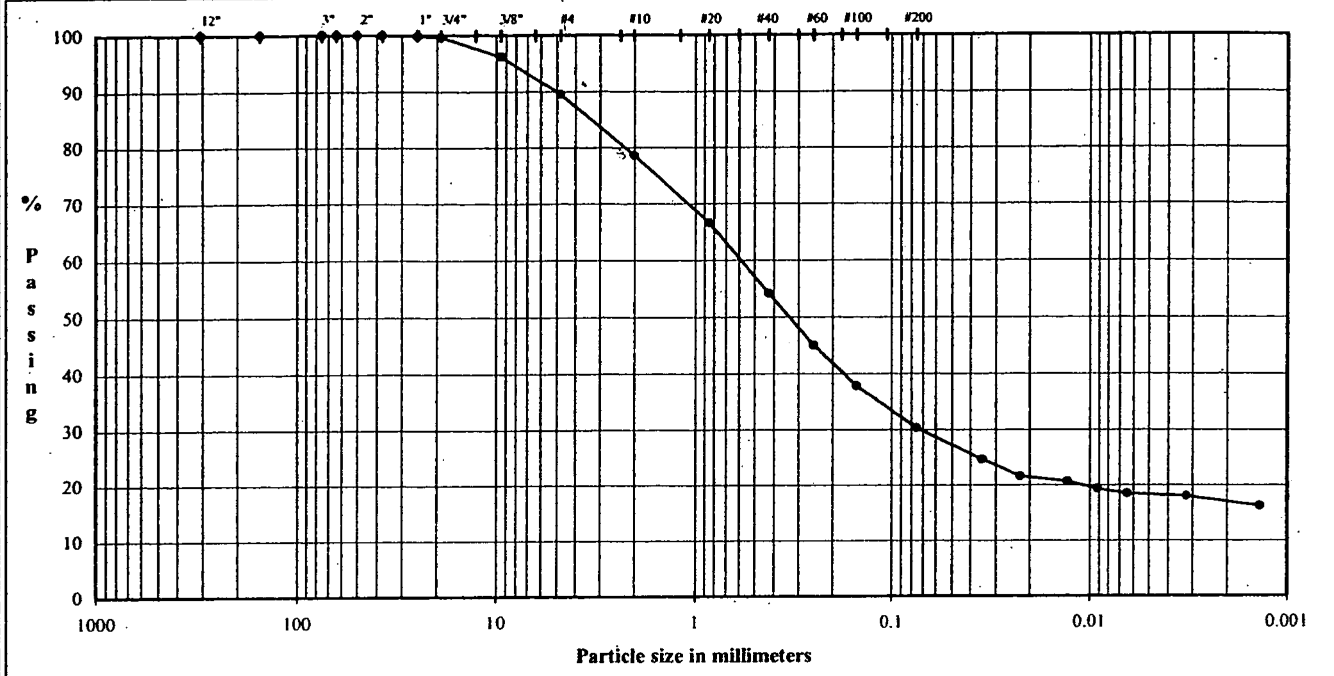
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO
SAMPLE ID: PF-4 Depth (ft): -
TYPE: BULK



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

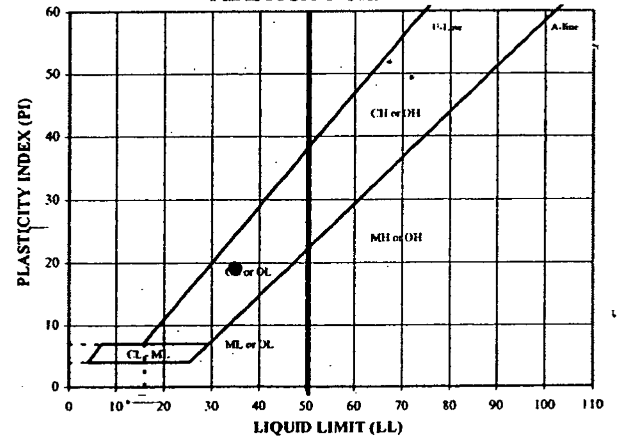
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0	Coarse Gravel	0.34
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	99.9		
0.75"	19.0	99.7	Fine Gravel	10.21
0.375"	9.5	96.2		
#4	4.8	89.4		
#10	2.00	78.6	Coarse Sand	10.87
#20	0.85	66.6	Medium Sand	24.43
#40	0.43	54.1		
#60	0.25	45.0	Fine Sand	23.89
#100	0.15	37.8		
#200	0.075	30.3		

Hydrometer Analysis

(mm)	%Finer		
0.035	24.6	Fines Silt or Clay	30.25
0.022	21.5		
0.013	20.7		
0.0091	19.3		
0.0064	18.5		
0.0032	18.0		
0.0014	16.3		

PLASTICITY CHART



ATTERBERG LIMITS

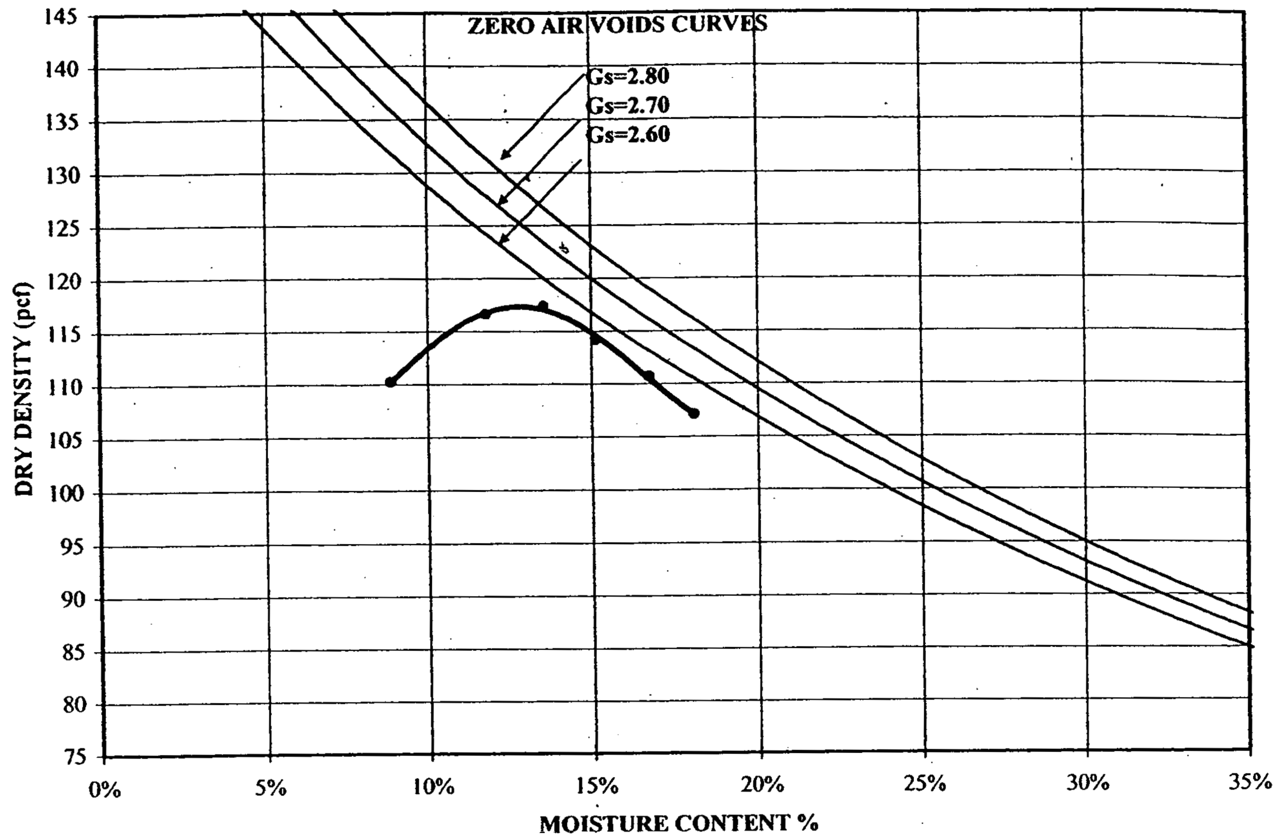
M_c	LL	PL	PI	SpG
17.4	35	16	19	

DESCRIPTION: Yellowish brown (10YR 5/8) clayey sand

USCS: SC

TECH: JR
DATE: 7/19/2004
REVIEW: MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	117.6	Corrected Maximum Dry Density (pcf)	122.9
OPTIMUM MOISTURE (%)	12.9	Corrected Optimum Moisture (%)	10.6

SAMPLE ID	PF-4
SAMPLE TYPE	BULK
SAMPLE DEPTH	—

LL	35
PL	16
PI	19
MC	1.2%

DESCRIPTION Yellowish brown (10YR 5/8) clayey sand

USCS SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	JR
DATE	7-20-04
REVIEW	MB

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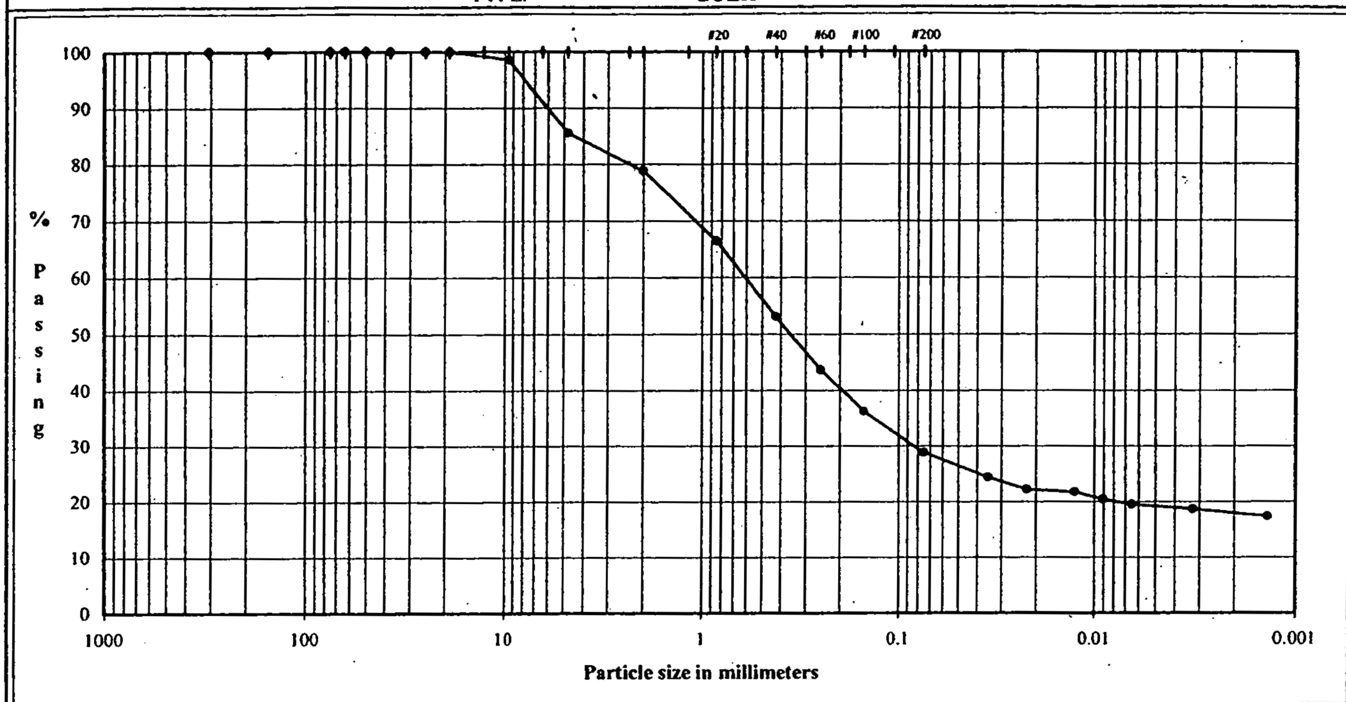
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO
SAMPLE ID: PF-5 Depth (ft): -
TYPE: BULK



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

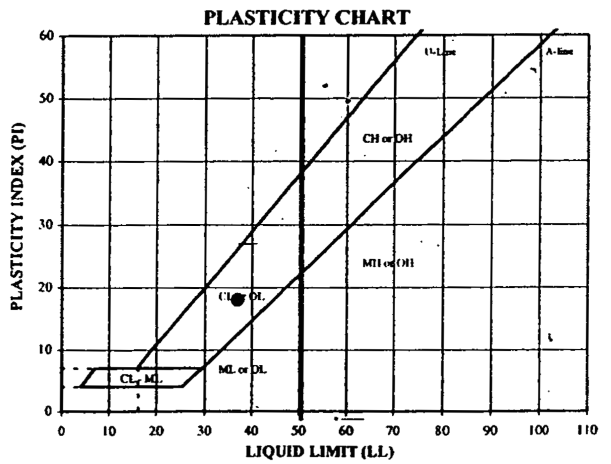
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
6.0"	154.2	100.0	Cobbles	0.00
3.0"	75.0	100.0		
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0	Coarse Gravel	0.00
0.75"	19.0	100.0		
0.375"	9.5	98.6		
#4	4.8	85.5	Fine Gravel	14.49
#10	2.00	78.8	Coarse Sand	6.66
#20	0.85	66.4		
#40	0.43	53.1	Medium Sand	25.79
#60	0.25	43.6		
#100	0.15	36.2		
#200	0.075	28.8	Fine Sand	24.21

Hydrometer Analysis

(mm)	%Finer		
0.035	24.4		
0.022	22.2		
0.013	21.7		
0.0090	20.4	Fines Silt or Clay	28.84
0.0065	19.5		
0.0032	18.6		
0.0014	17.3		

PLASTICITY CHART



ATTERBERG LIMITS

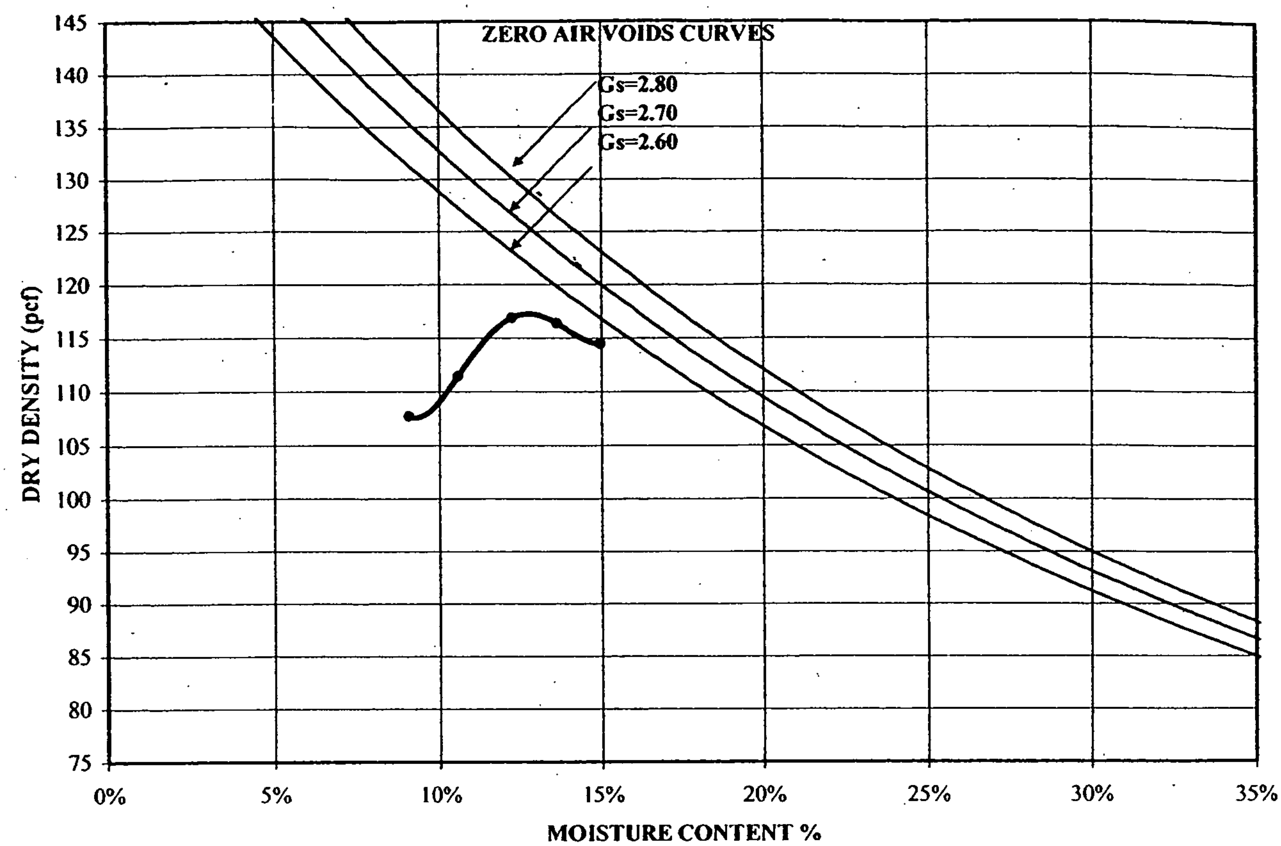
M_c	LL	PL	PI	SpG
12.8	37	19	18	

DESCRIPTION: Yellowish brown (10 YR 5/8)

USCS: SC

TECH: JR
DATE: 7/19/2004
REVIEW: MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	117.4	Corrected Maximum Dry Density (pcf)	121.9
OPTIMUM MOISTURE (%)	12.7	Corrected Optimum Moisture (%)	10.8

SAMPLE ID	PF-5
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	37
PL	19
PI	18
MC	12.8

DESCRIPTION	Yellowish brown (10 YR 5/8)
USCS	SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

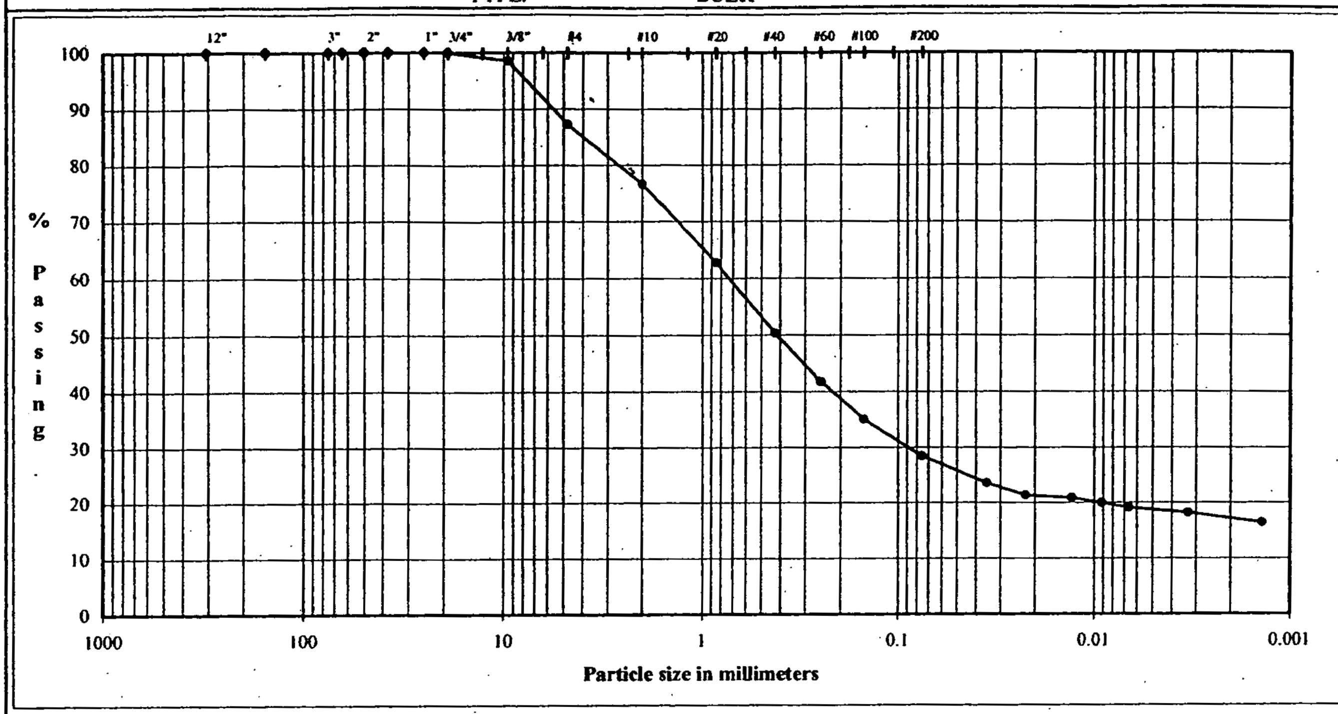
TECH	JR
DATE	7-20-04
REVIEW	MB

July-04 043-2246.0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO
SAMPLE ID: PF-5 Dup Depth (ft): -
TYPE: BULK



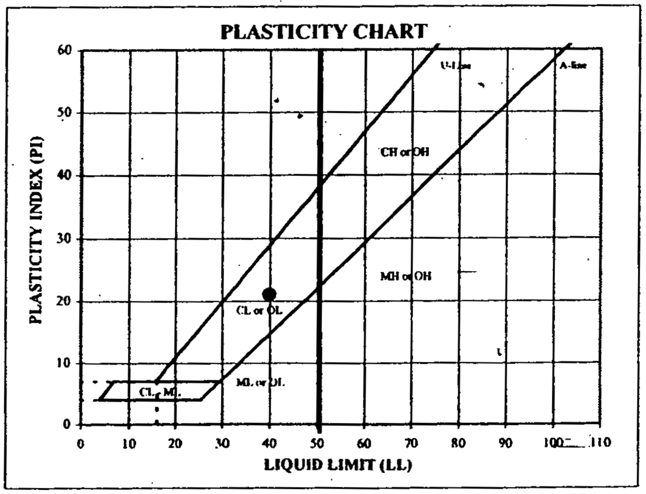
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
6.0"	154.2	100.0	Cobbles	0.00
3.0"	75.0	100.0		
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0	Coarse Gravel	0.00
0.75"	19.0	100.0		
0.375"	9.5	98.6		
#4	4.8	87.2	Fine Gravel	12.78
#10	2.00	76.5	Coarse Sand	10.68
#20	0.85	62.7		
#40	0.43	50.3	Medium Sand	26.21
#60	0.25	41.7		
#100	0.15	35.0		
#200	0.075	28.4	Fine Sand	21.97

Hydrometer Analysis

(mm)	%Finer		
0.035	23.5		
0.022	21.3		
0.013	20.8		
0.0091	19.9	Fines Silt or Clay	28.36
0.0066	19.0		
0.0033	18.2		
0.0014	16.4		



ATTERBERG LIMITS

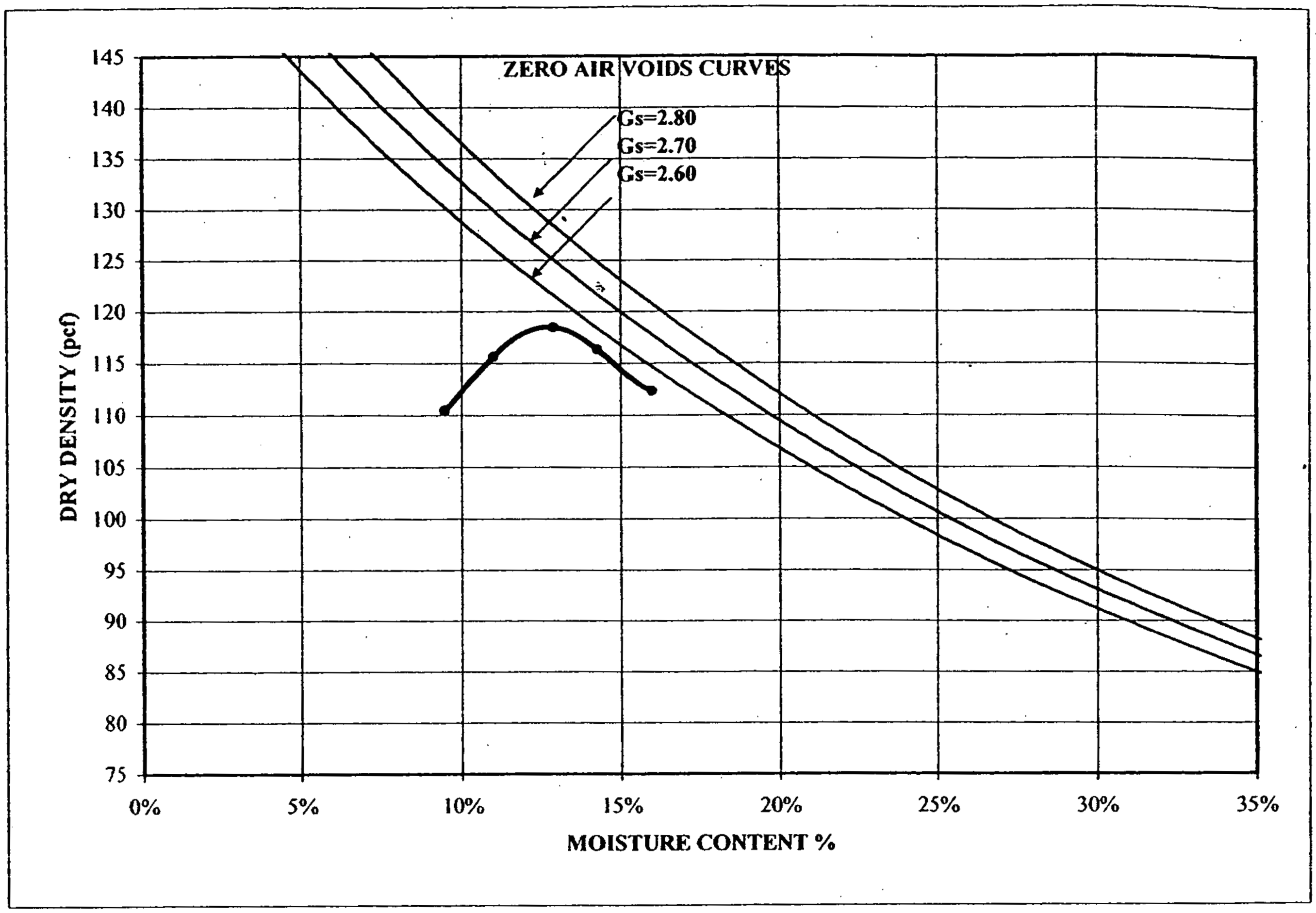
M_c	LL	PL	PI	SpG
11.4	40	19	21	

DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand

USCS: SC

TECH	JR
DATE	7/21/2004
REVIEW	MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	118.4	Corrected Maximum Dry Density (pcf)	122.3
OPTIMUM MOISTURE (%)	12.8	Corrected Optimum Moisture (%)	11.1

SAMPLE ID	PF-5 Dup
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	40
PL	19
PI	21
MC	11.4

DESCRIPTION	Yellowish brown (10 YR 5/8) clayey sand
USCS	SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	DT
DATE	7-22-04
REVIEW	MB

July-04

043-2246.0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

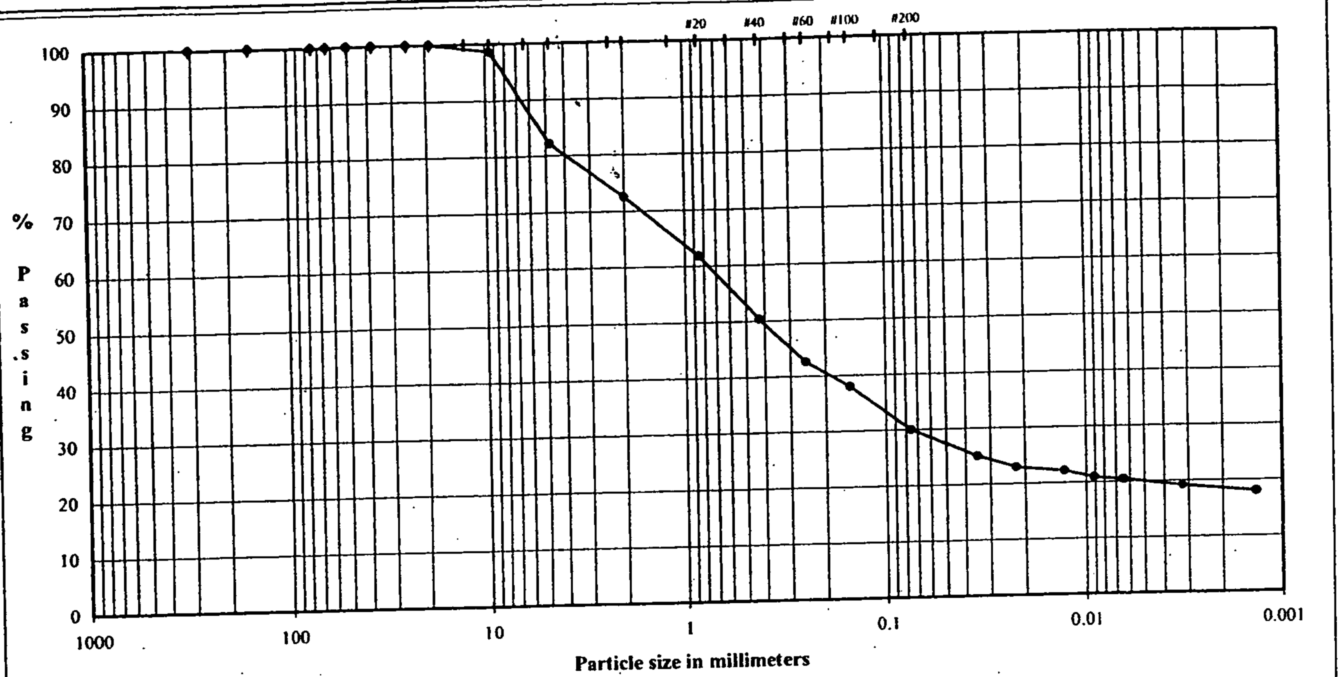
ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO

SAMPLE ID: PF-6

TYPE: BULK

Depth (ft): -



COBBLES	GRAVEL Coarse	GRAVEL Fine	SAND Coarse	SAND Medium	SAND Fine	FINES Silt or Clay

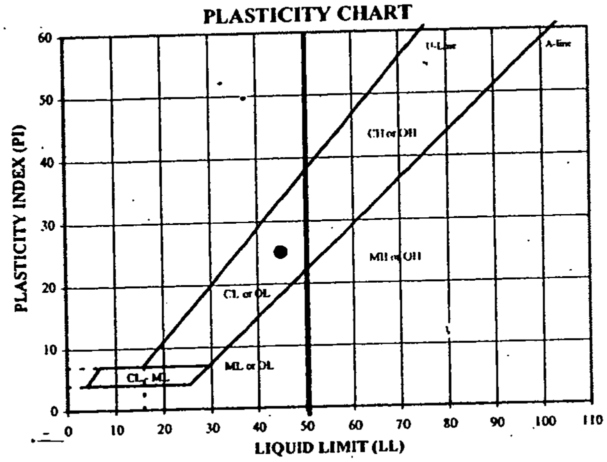
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0	Coarse Gravel	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Fine Gravel	17.91
0.375"	9.5	98.6		
#4	4.8	82.1		
#10	2.00	72.5	Coarse Sand	9.58
#20	0.85	61.8	Medium Sand	22.15
#40	0.43	50.4		
#60	0.25	42.5	Fine Sand	20.38
#100	0.15	37.9		
#200	0.075	30.0		

Hydrometer Analysis

(mm)	%Finer		
0.034	25.0	Fines. Silt or Clay	29.98
0.022	22.9		
0.013	22.1		
0.0091	20.8		
0.0064	20.4		
0.0032	19.2		
0.0014	17.9		

PLASTICITY CHART



ATTERBERG LIMITS

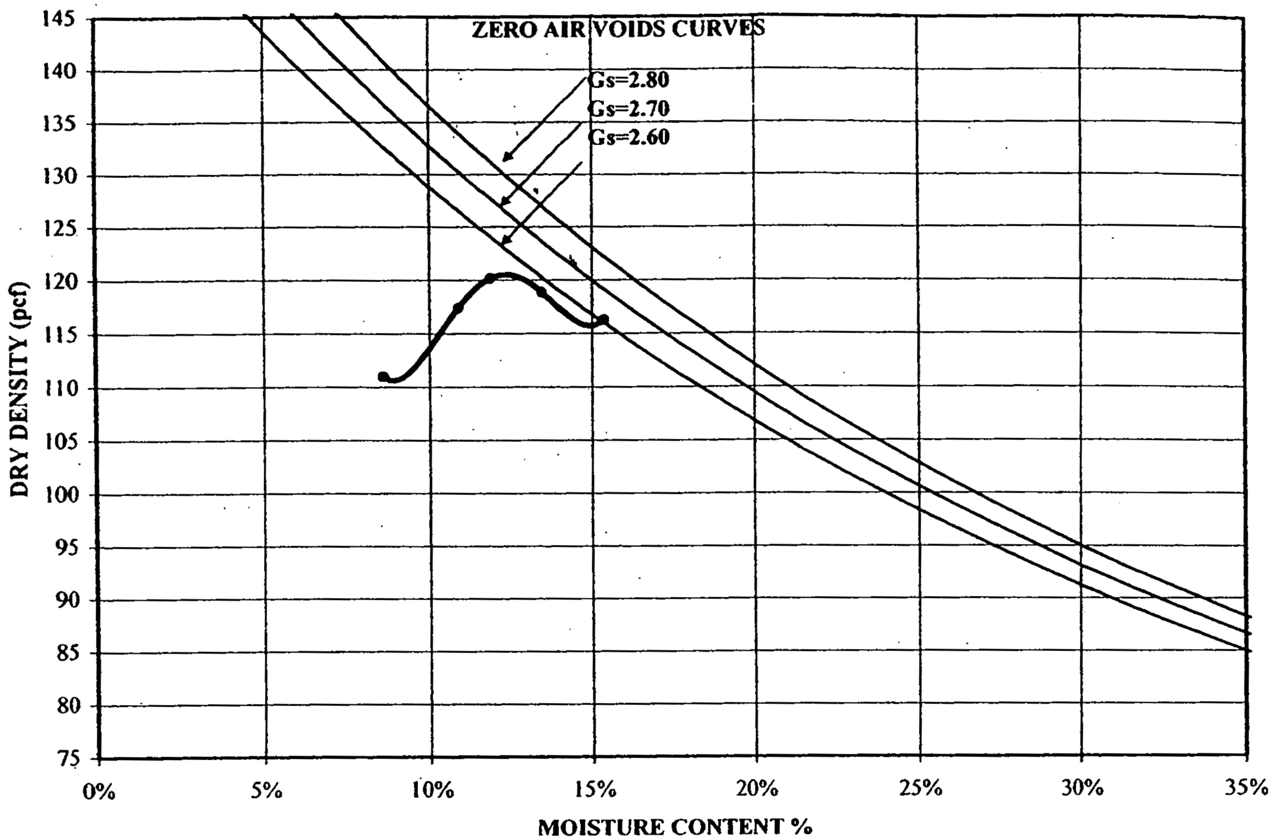
M_c	LL	PL	PI	SpG
11.5	45	20	25	

DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand with gravel

USCS: SC

TECH	JR
DATE	7/19/2004
REVIEW	MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD B



MAXIMUM DRY DENSITY (pcf)	120.3	Corrected Maximum Dry Density (pcf)	120.3
OPTIMUM MOISTURE (%)	12.5	Corrected Optimum Moisture (%)	12.5

SAMPLE ID	PF-6
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	45
PL	20
PI	25
MC	11.5%

DESCRIPTION	Yellowish brown (10 YR 5/8) clayey sand with gravel
USCS	SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

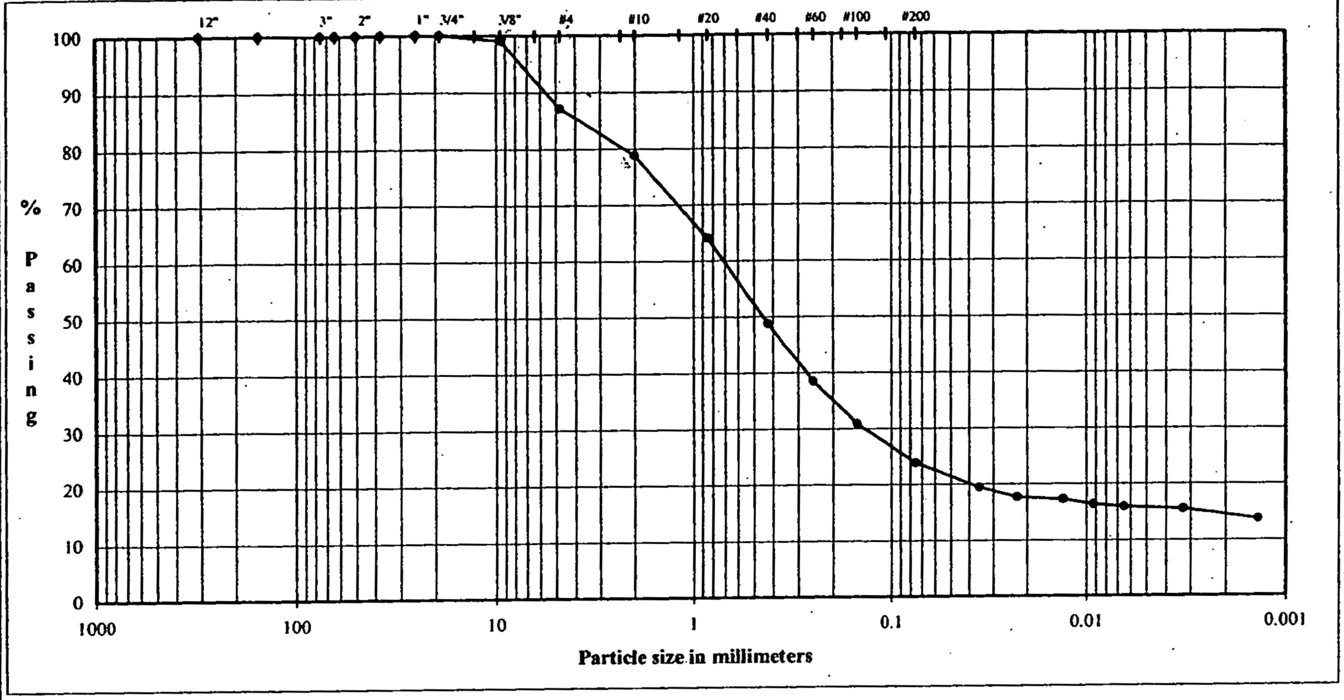
TECH	JR
DATE	7-20-04
REVIEW	MB

July-04 | 043-2246.0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO
SAMPLE ID: PF-7 Depth (ft): -
TYPE: BULK



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

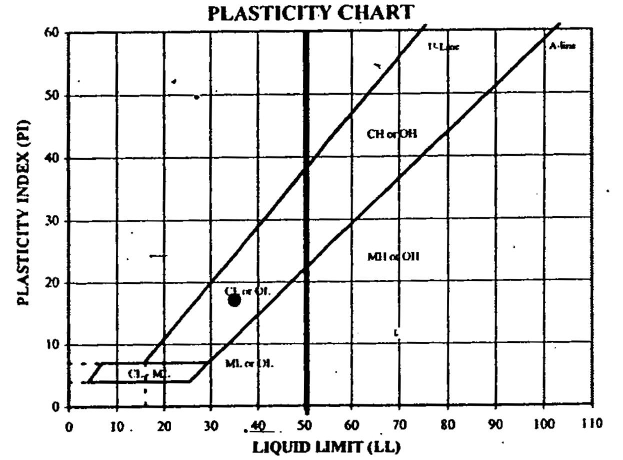
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0	Coarse Gravel	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0		
0.375"	9.5	99.1	Fine Gravel	12.89
#4	4.8	87.1		
#10	2.00	78.8	Coarse Sand	8.34
#20	0.85	64.0	Medium Sand	30.05
#40	0.43	48.7		
#60	0.25	38.5	Fine Sand	24.87
#100	0.15	30.8		
#200	0.075	23.8		

Hydrometer Analysis

(mm)	%Finer		
0.035	19.4	Fines Silt or Clay	23.85
0.023	17.7		
0.013	17.2		
0.0092	16.3		
0.0064	15.9		
0.0033	15.4		
0.0014	13.7		

PLASTICITY CHART



ATTERBERG LIMITS

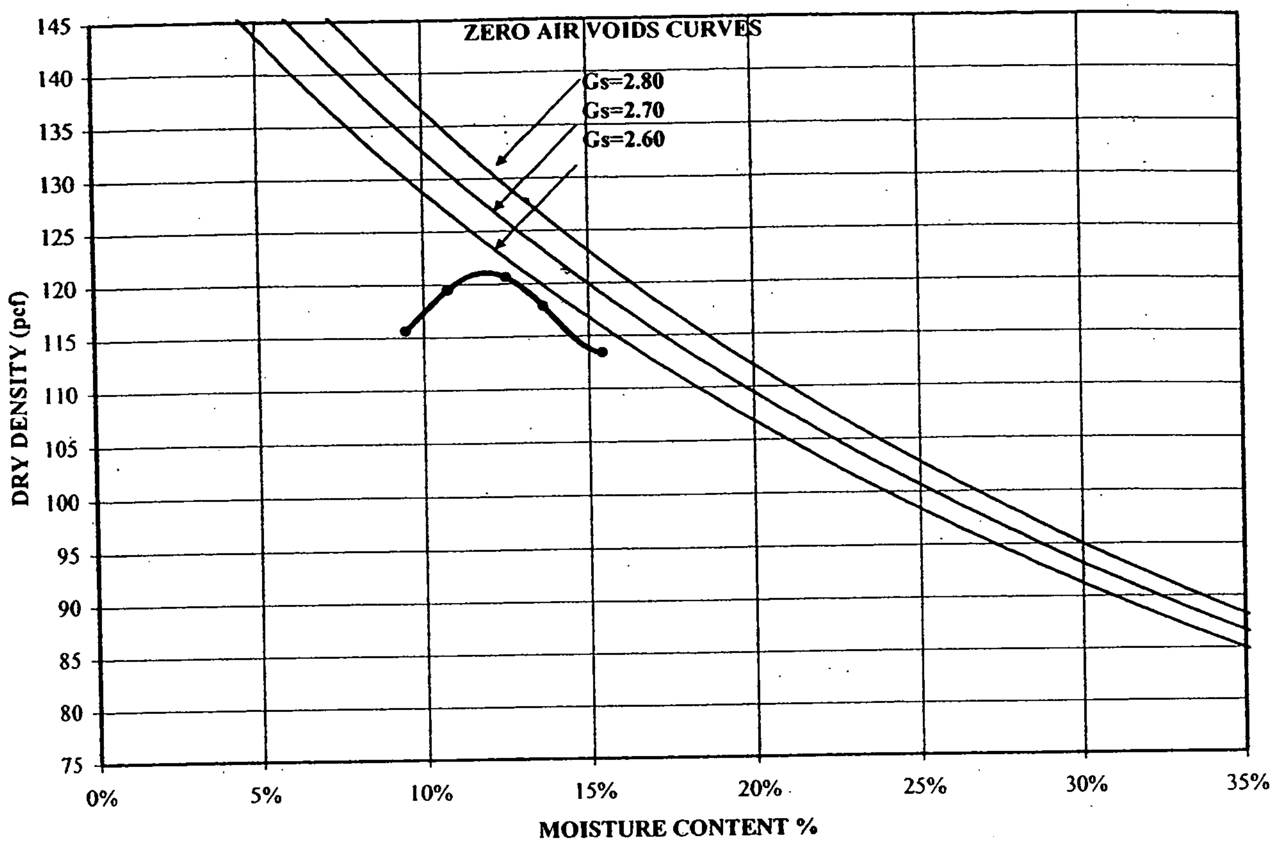
M_c	LL	PL	PI	SpG
13.5	35	18	17	

DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand

USCS: SC

TECH	JR
DATE	7/19/2004
REVIEW	MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	121.1	Corrected Maximum Dry Density (pcf)	125.1
OPTIMUM MOISTURE (%)	12.0	Corrected Optimum Moisture (%)	10.3

SAMPLE ID	PF-7
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	35
PL	18
PI	17
MC	13.5

DESCRIPTION	Yellowish brown (10 YR 5/8) clayey sand
USCS	SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	JR
DATE	7-20-04
REVIEW	MB

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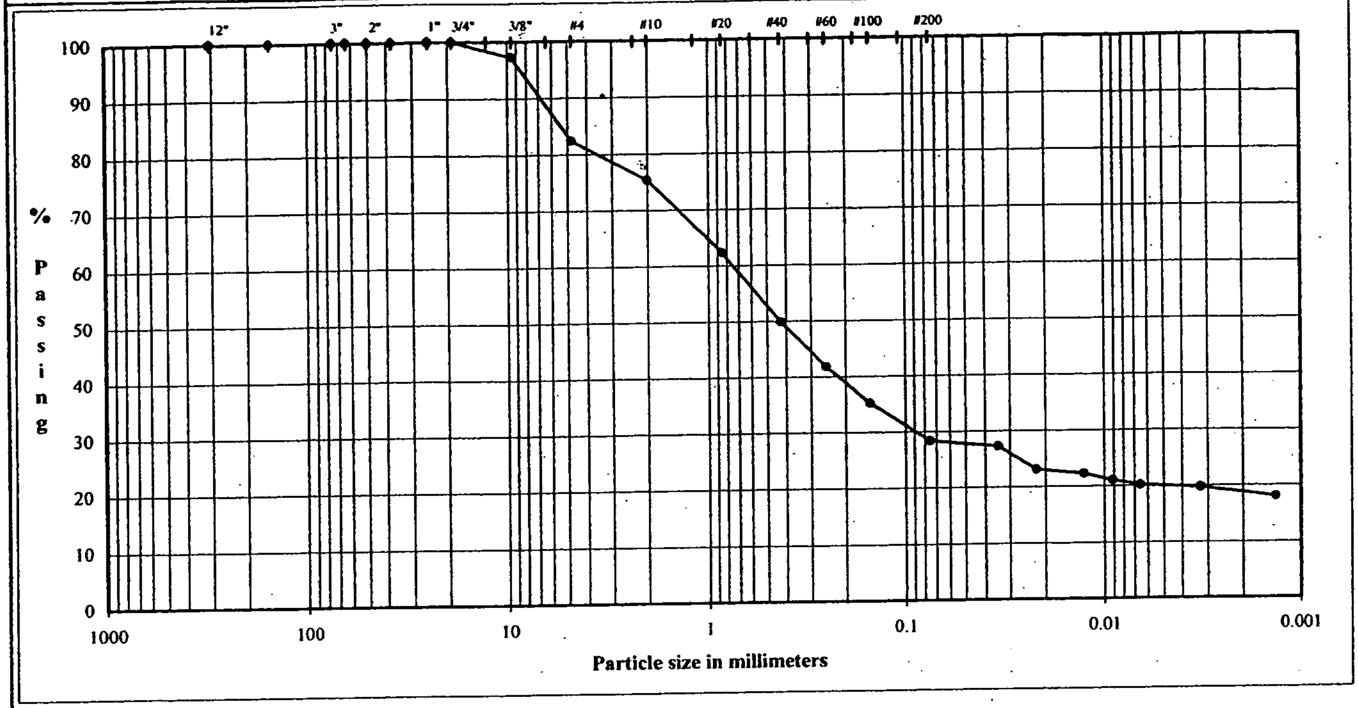
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Rocky Flats/Field & Lab Testing/CO**
SAMPLE ID: **PF-8** Depth (ft): -
TYPE: **BULK**



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

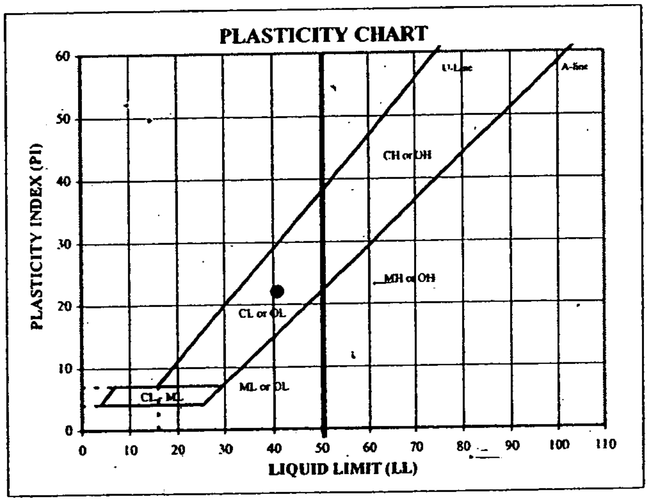
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0	Coarse Gravel	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0		
0.375"	9.5	97.3	Fine Gravel	17.65
#4	4.8	82.4		
#10	2.00	75.3	Coarse Sand	7.03
#20	0.85	62.3	Medium Sand	25.41
#40	0.43	49.9		
#60	0.25	41.8	Fine Sand	21.57
#100	0.15	35.2		
#200	0.075	28.3		

Hydrometer Analysis

(mm)	%Finer		
0.034	27.3	Fines Silt or Clay	28.34
0.022	23.1		
0.013	22.2		
0.0091	21.0		
0.0065	20.1		
0.0032	19.7		
0.0013	18.0		

PLASTICITY CHART



ATTERBERG LIMITS

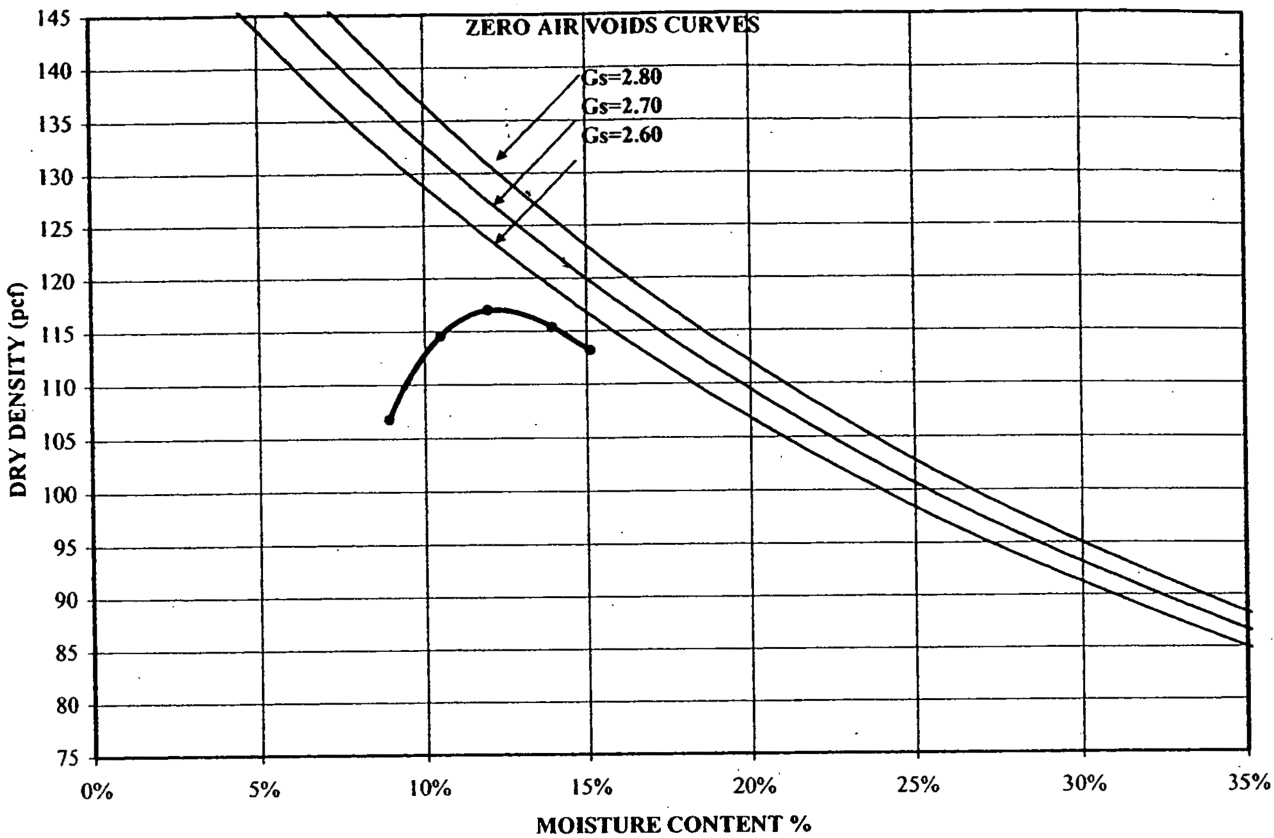
M_c	LL	PL	PI	SpG
14.9	41	19	22	–

DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand with gravel

USCS: SC

TECH	JR
DATE	7/15/2004
REVIEW	NG

MOISTURE / DRY DENSITY CURVE
D 698 METHOD B



MAXIMUM DRY DENSITY (pcf)	117.2	Corrected Maximum Dry Density (pcf)	117.9
OPTIMUM MOISTURE (%)	12.2	Corrected Optimum Moisture (%)	11.9

SAMPLE ID	PF-8
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	41
PL	19
PI	22
MC	14.9%

DESCRIPTION	Yellowish brown (10 YR 5/8) clayey sand with gravel
USCS	SC

Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	DT
DATE	7/16/04
REVIEW	NG

377

July-04

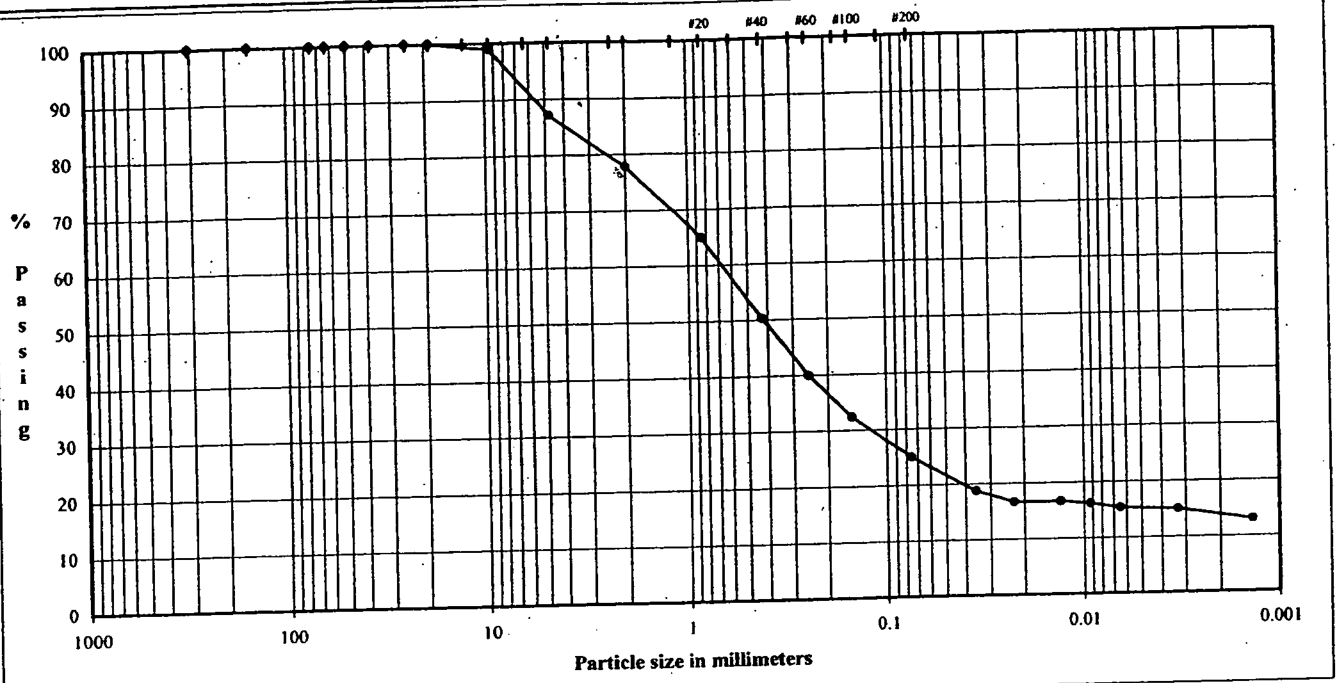
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO

SAMPLE ID: PF-9 Depth (ft): -

TYPE: BULK



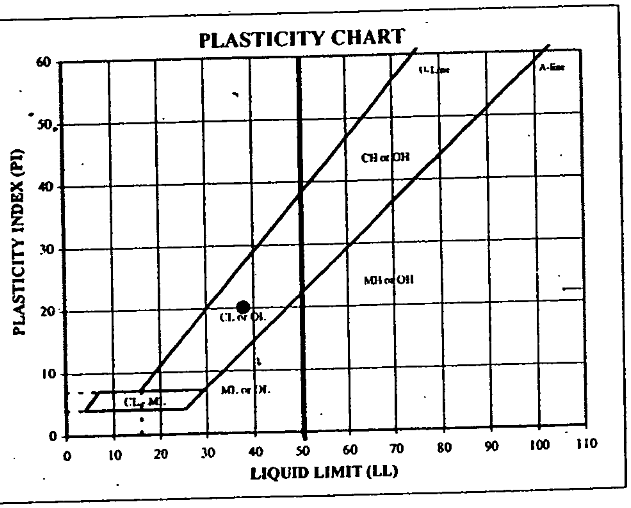
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0	Coarse Gravel	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0		
0.375"	9.5	99.0	Fine Gravel	12.85
#4	4.8	87.2		
#10	2.00	77.8	Coarse Sand	9.38
#20	0.85	65.0	Medium Sand	27.47
#40	0.43	50.3		
#60	0.25	39.9	Fine Sand	25.38
#100	0.15	32.3		
#200	0.075	24.9		

Hydrometer Analysis

(mm)	%Finer		
0.035	18.8	Fines Silt or Clay	24.92
0.023	16.6		
0.013	16.6		
0.0092	16.2		
0.0064	15.3		
0.0033	14.9		
0.0014	13.0		



ATTERBERG LIMITS

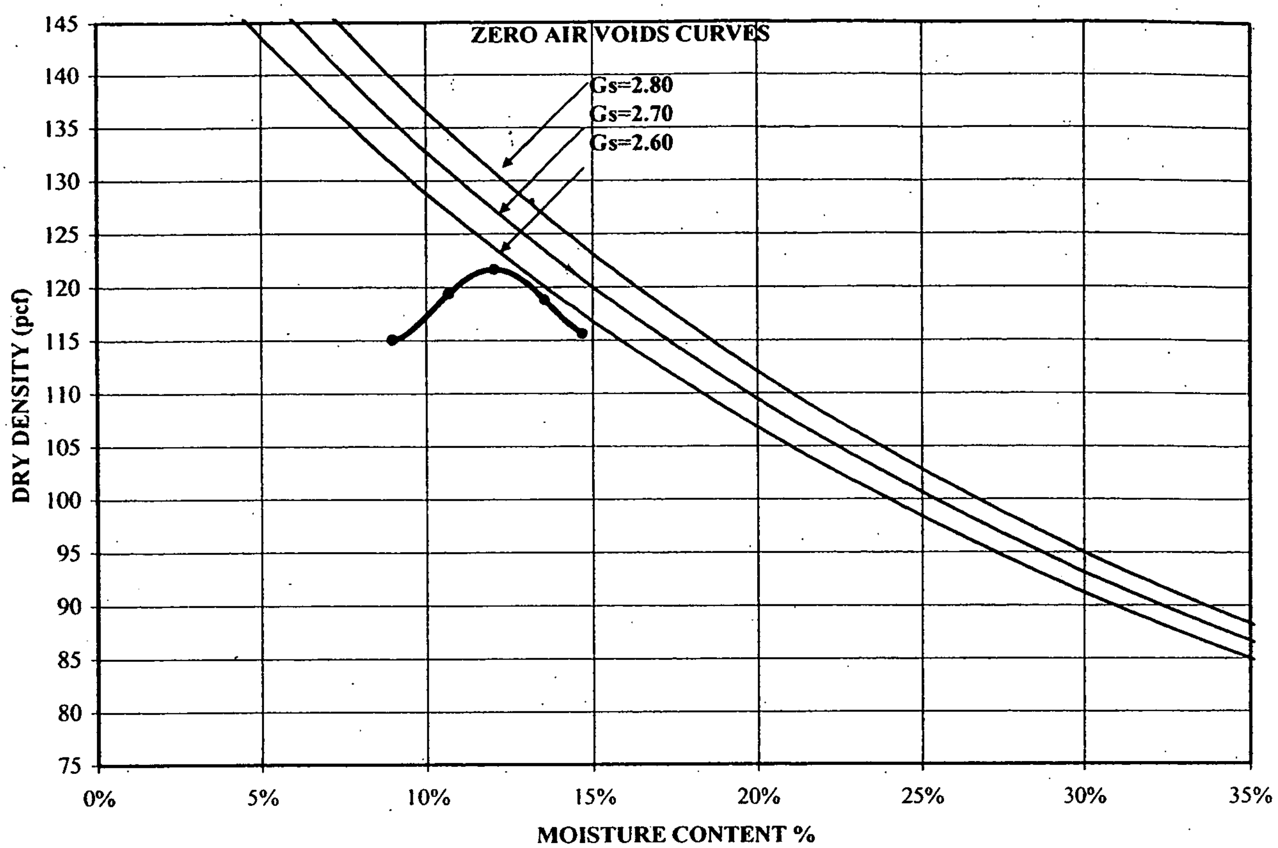
M_c	LL	PL	PI	SpG
13.8	38	18	20	

DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand

USCS: SC

TECH	JR
DATE	7/19/2004
REVIEW	MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	121.6	Corrected Maximum Dry Density (pcf)	125.1
OPTIMUM MOISTURE (%)	12.0	Corrected Optimum Moisture (%)	10.4

SAMPLE ID	PF-9
SAMPLE TYPE	BULK
SAMPLE DEPTH	-

LL	38
PL	18
PI	20
MC	13.8%

DESCRIPTION	Yellowish brown (10 YR 5/8) clayey sand
USCS	SC

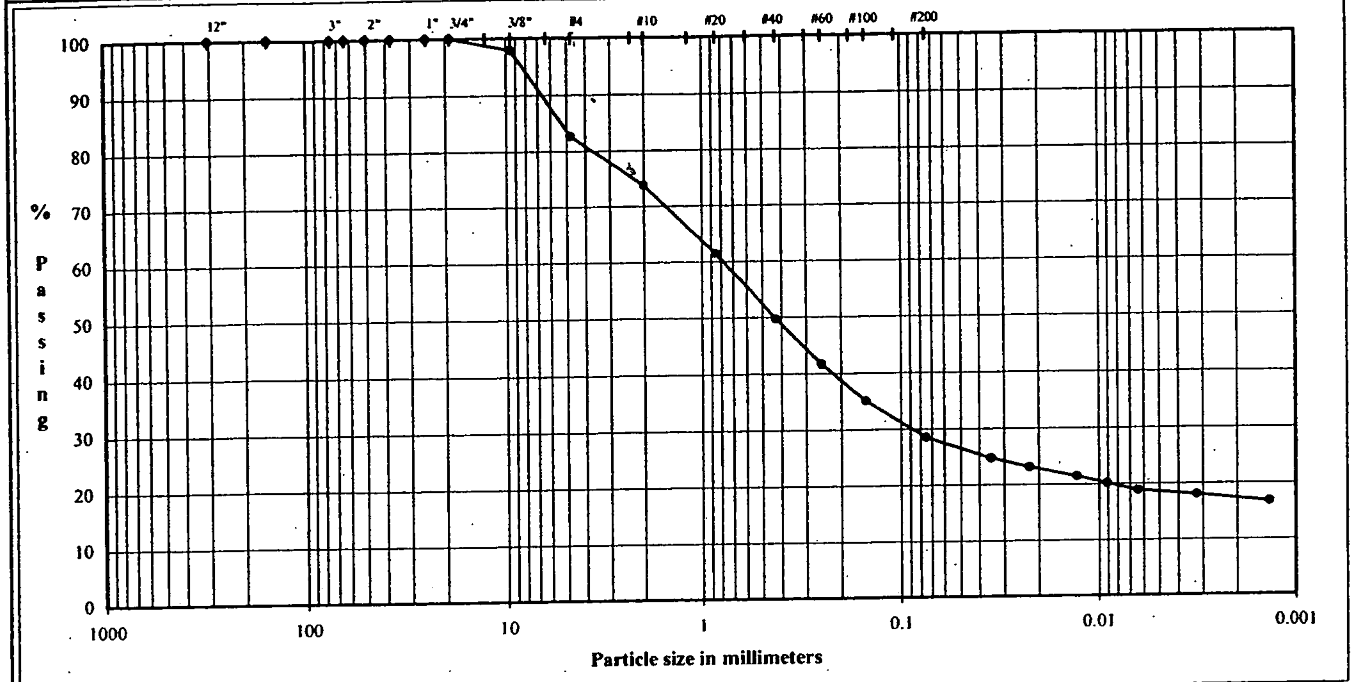
Rocky Flats/Field & Lab Testing/CO
043-2246.0001

TECH	JR
DATE	7-20-04
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO
SAMPLE ID: PF-10
TYPE: BULK
Depth (ft): -



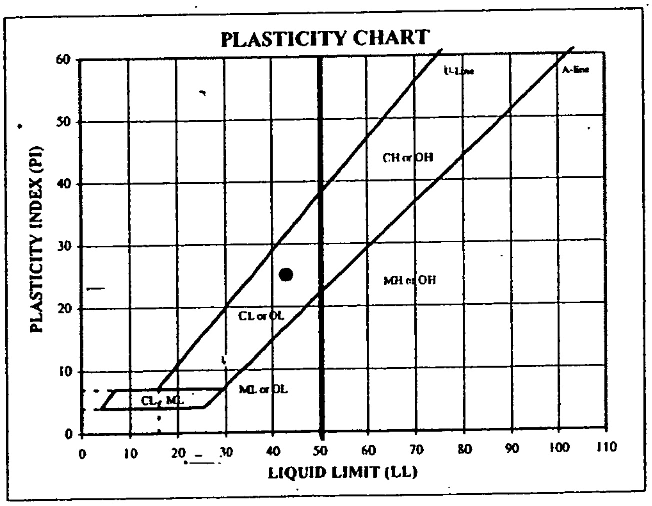
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0	Coarse Gravel	0.00
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0		
0.375"	9.5	97.9	Fine Gravel	17.34
#4	4.8	82.7		
#10	2.00	73.7	Coarse Sand	8.92
#20	0.85	61.4	Medium Sand	24.10
#40	0.43	49.6		
#60	0.25	41.6	Fine Sand	21.13
#100	0.15	35.1		
#200	0.075	28.5		

Hydrometer Analysis

(mm)	%Finer		
0.035	24.8	Fines Silt or Clay	28.52
0.022	23.1		
0.013	21.4		
0.0091	20.1		
0.0064	18.9		
0.0032	18.0		
0.0014	16.8		



ATTERBERG LIMITS

M,	LL	PL	PI	SpG
14.8	43	18	25	

DESCRIPTION: Yellowish brown (10 YR 5/8) clayey sand with gravel

USCS: SC

TECH	JR
DATE	7/21/2004
REVIEW	MB

CENTENNIAL AGGREGATES

ROCKY FLATS ALLUVIUM

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RFA

APR= Alluvial Pit Run

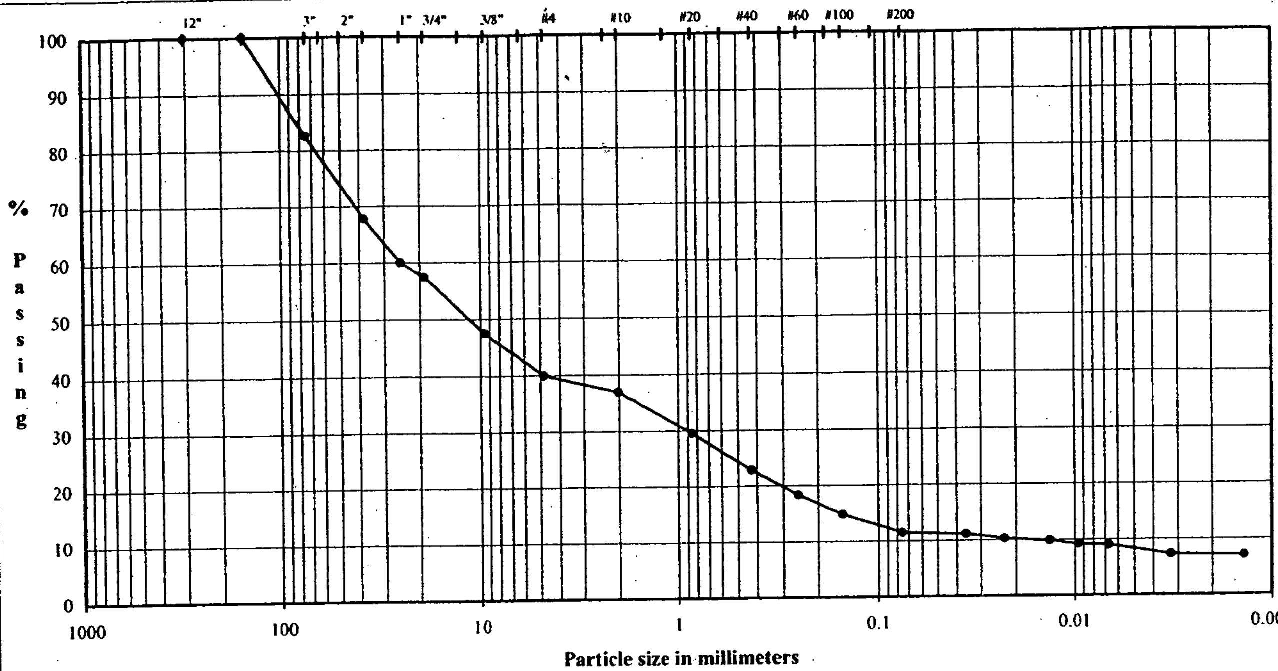
October-04

043-2246.0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO
SAMPLE ID: APR-1 Depth (ft): –
TYPE: BULK



COBBLES	GRAVEL Coarse	GRAVEL Fine	SAND Coarse	SAND Medium	SAND Fine	FINES Silt or Clay

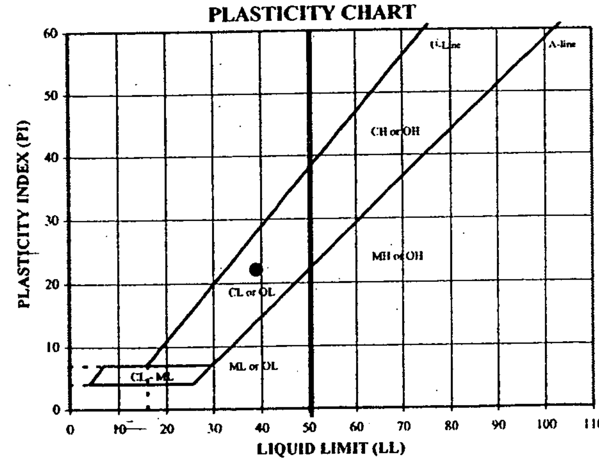
U.S. Standard Sieves Sizes and Numbers

Sieve	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
12.0"	304.8	100.0		
6.0"	154.2	100.0	Cobbles	17.40
6.0"	154.2	100.0		
6.0"	154.2	100.0		
3.0"	75.0	82.6		
1.5"	37.5	67.7		
1.0"	25.0	60.0	Coarse Gravel	25.22
0.75"	19.0	57.4		
0.375"	9.5	47.4		
#4	4.8	39.9	Fine Gravel	17.51
#10	2.00	36.9	Coarse Sand	2.98
#20	0.85	29.5		
#40	0.43	22.8	Medium Sand	14.07
#60	0.25	18.3		
#100	0.15	14.9		
#200	0.075	11.4	Fine Sand	11.38

Hydrometer Analysis

(mm)	%Finer	Classification	Percentage
0.036	11.1		
0.023	10.2		
0.013	9.8		
0.0095	9.2	Fines Silt or Clay	11.44
0.0067	9.0		
0.0033	7.3		
0.0014	7.0		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
10.4	39	17	22	2.70

DESCRIPTION: Strong brown (7.55 YR 5/6) clayey gravel with sand

USCS: GC

TECH	JR
DATE	11/3/2004
REVIEW	MB

180

RFA

October-04 043-2246.0001

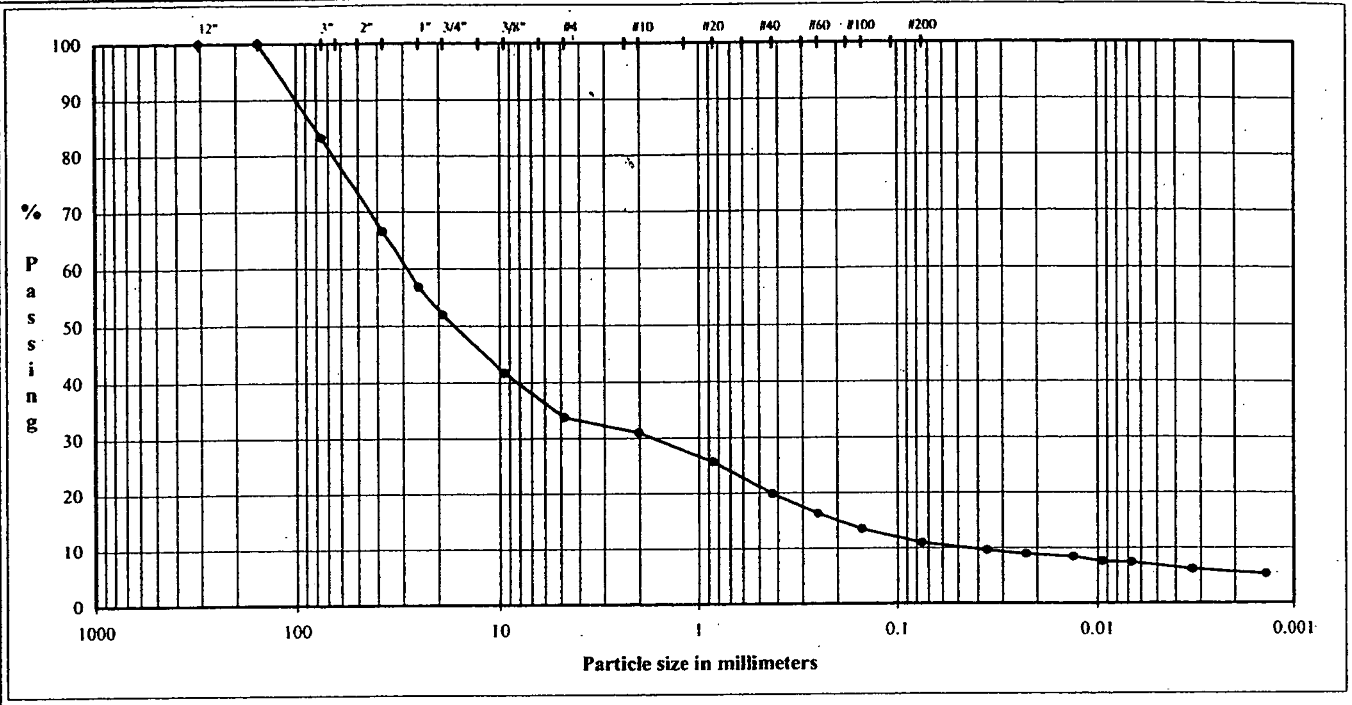
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Rocky Flats/Field & Lab Testing/CO

SAMPLE ID: APR-2 Depth (ft): –

TYPE: BULK



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

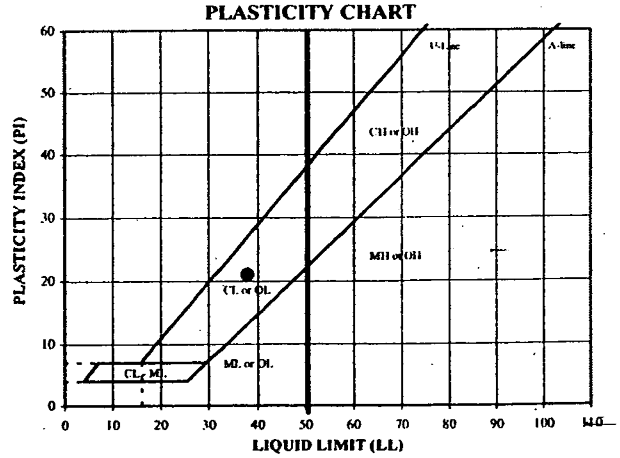
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	16.90
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	31.22
6.0"	154.2	100.0		
3.0"	75.0	83.1		
1.5"	37.5	66.5		
1.0"	25.0	56.7		
0.75"	19.0	51.9		
0.375"	9.5	41.7	Fine Gravel	18.23
#4	4.8	33.7		
#10	2.00	30.9	Coarse Sand	2.77
#20	0.85	25.6	Medium Sand	11.03
#40	0.43	19.9		
#60	0.25	16.3	Fine Sand	8.91
#100	0.15	13.4		
#200	0.075	10.9		

Hydrometer Analysis

(mm)	%Finer		
0.036	9.6	Fines Silt or Clay	10.94
0.023	8.9		
0.013	8.4		
0.0094	7.5		
0.0067	7.3		
0.0033	6.1		
0.0014	5.2		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
9.8	38	17	21	2.70

DESCRIPTION: Strong brown (7.55 YR 5/6) clayey gravel with sand

USCS: GC

TECH	JR
DATE	11/3/2004
REVIEW	MB

CENTENNIAL AGGREGATES DRAIN ROCK

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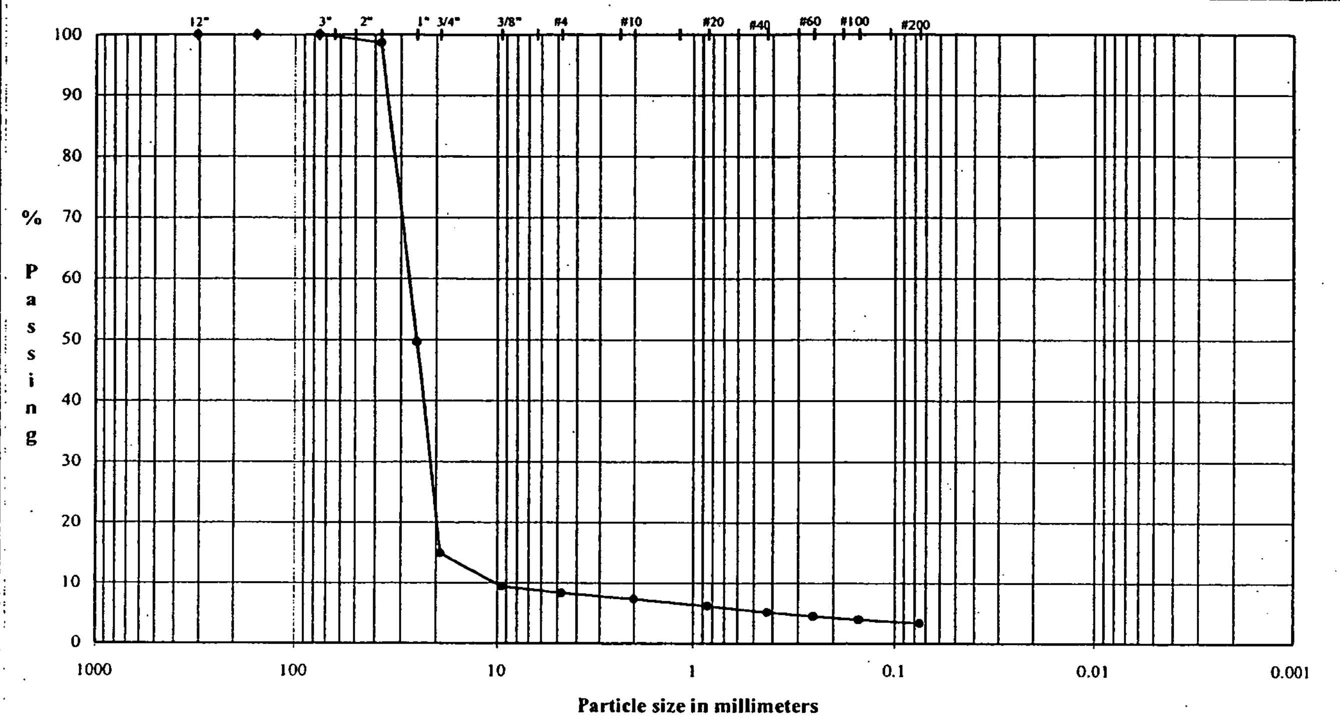
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

Centennial Drain Rock

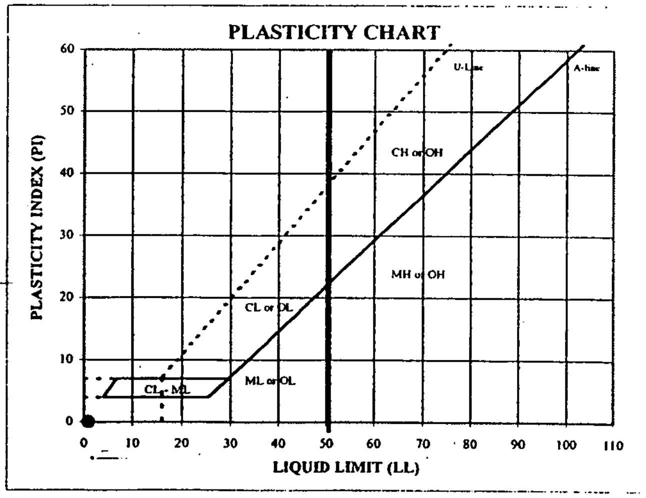
PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: DRS-01 Depth (ft): –
TYPE: Pail



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
6.0"	154.2	100.0	Cobbles	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	98.7		
1.0"	25.0	49.6		
0.75"	19.0	14.9	Coarse Gravel	85.09
0.375"	9.5	9.4		
#4	4.8	8.3	Fine Gravel	6.58
#10	2.0	7.3	Coarse Sand	0.98
#20	0.9	6.2		
#40	0.4	5.1	Medium Sand	2.20
#60	0.3	4.5		
#100	0.2	3.9		
#200	0.1	3.3	Fine Sand	1.81
			Fines	3.33



ATTERBERG LIMITS

M_c	LL	PL	PI	SG
–	–	–	–	–

DESCRIPTION: Yellowish brown poorly graded gravel

USCS: GP

TECH	MGC
DATE	5/17/05
REVIEW	MB

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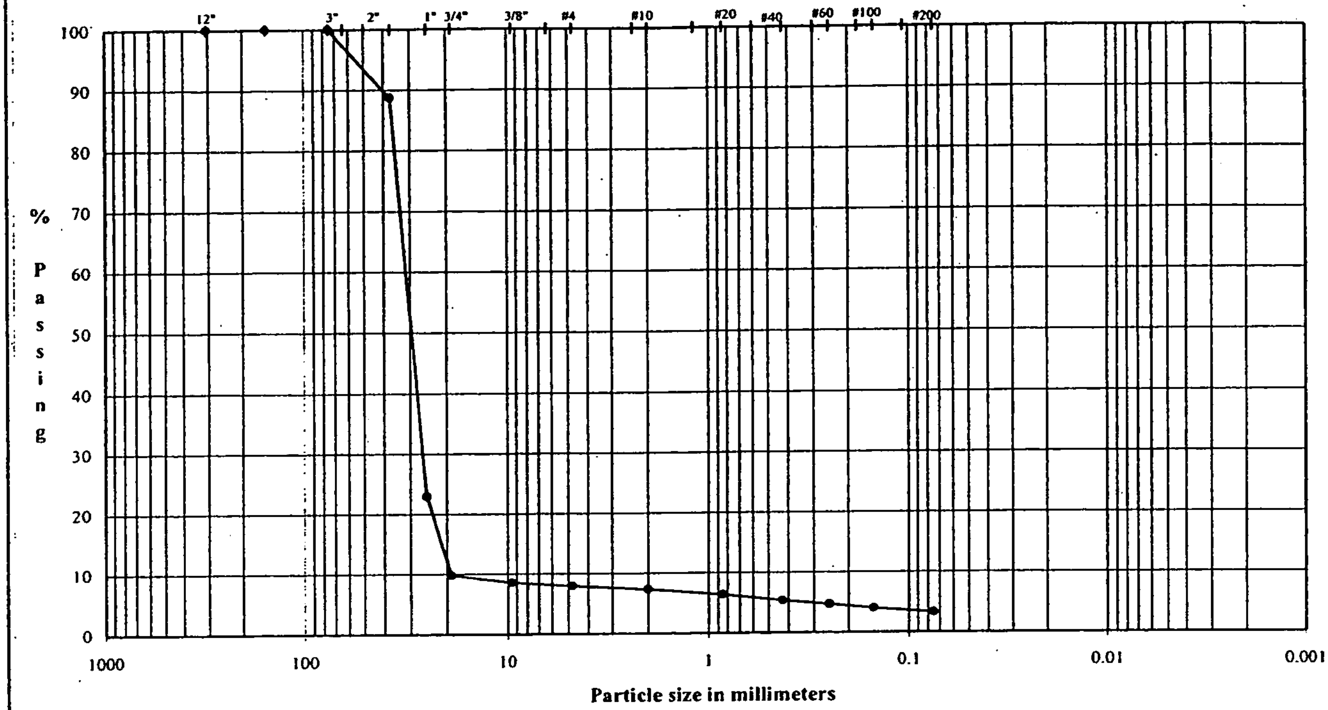
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

CENTENNIAL DRAIN ROCK

PROJECT NAME:	Kaiser Hill/Rocky Flats Field & Lab		
SAMPLE ID:	DRS-02	Depth (ft):	–
TYPE:	Pail		

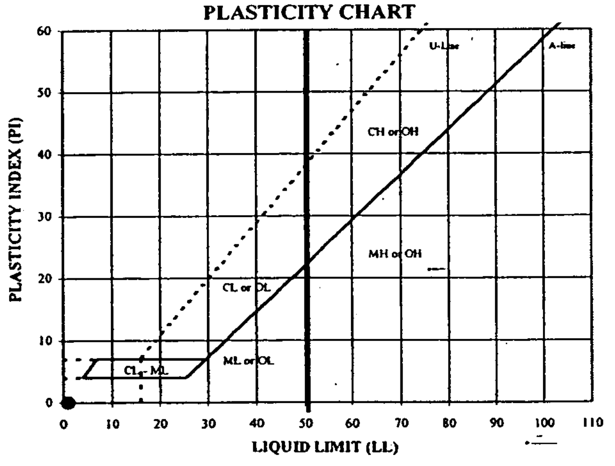


COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	90.20
3.0"	75.0	100.0		
1.5"	37.5	88.7		
1.0"	25.0	22.9		
0.75"	19.0	9.8		
0.375"	9.5	8.6	Fine Gravel	1.88
#4	4.8	7.9		
#10	2.0	7.3	Coarse Sand	0.61
#20	0.9	6.4	Medium Sand	1.97
#40	0.4	5.3		
#60	0.3	4.6	Fine Sand	2.05
#100	0.2	4.0		
#200	0.1	3.3		
			Fines	3.29

PLASTICITY CHART



ATTERBERG LIMITS

M,	LL	PL	PI	SG
–	–	–	–	–

DESCRIPTION: Yellowish brown poorly graded gravel

USCS: GP

TECH	MGC
DATE	5/17/05
REVIEW	MB

Pioneer Sand & Gravel

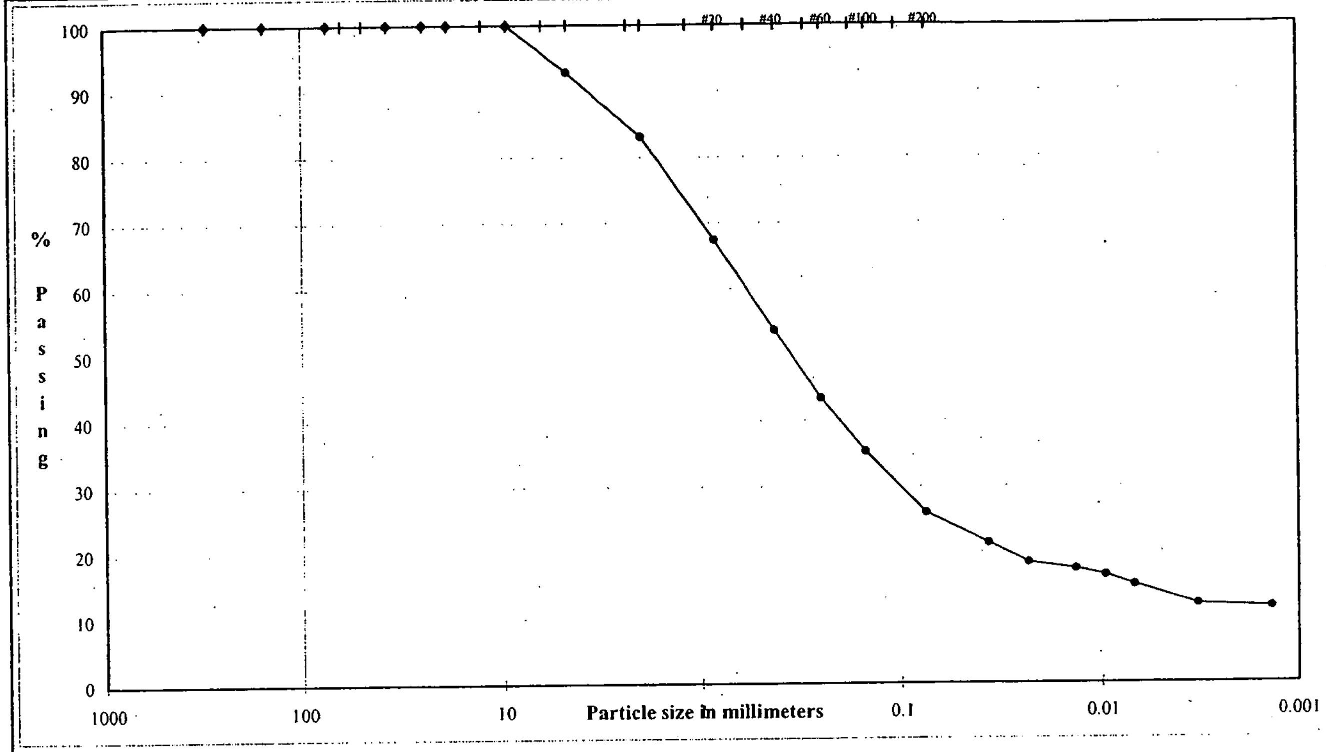
Re-Grade Material

183

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: PSE-2 Depth (ft): -
TYPE: Pail



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

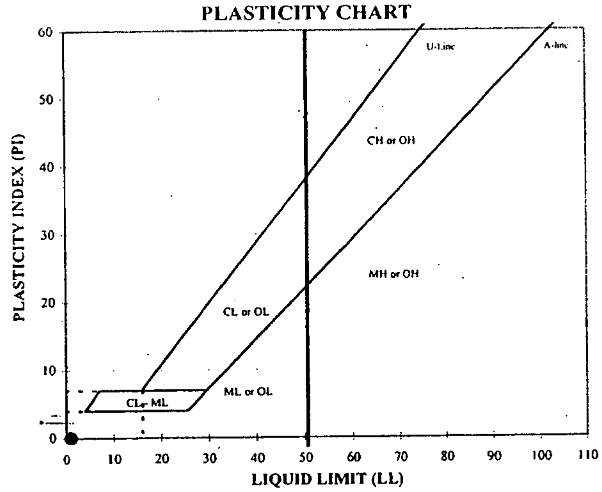
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Fine Gravel	7.15
0.375"	9.5	100.0		
#4	4.8	92.9		
#10	2.00	83.1	Coarse Sand	9.73
#20	0.85	67.4	Medium Sand	29.43
#40	0.43	53.7		
#60	0.25	43.4	Fine Sand	27.71
#100	0.15	35.3		
#200	0.075	26.0		

Hydrometer Analysis

(mm)	%Finer		
0.037	21.4	Fines Silt or Clay	25.98
0.023	18.4		
0.014	17.4		
0.0096	16.4		
0.0069	14.9		
0.0033	11.9		
0.0014	11.4		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	--	--	--	--

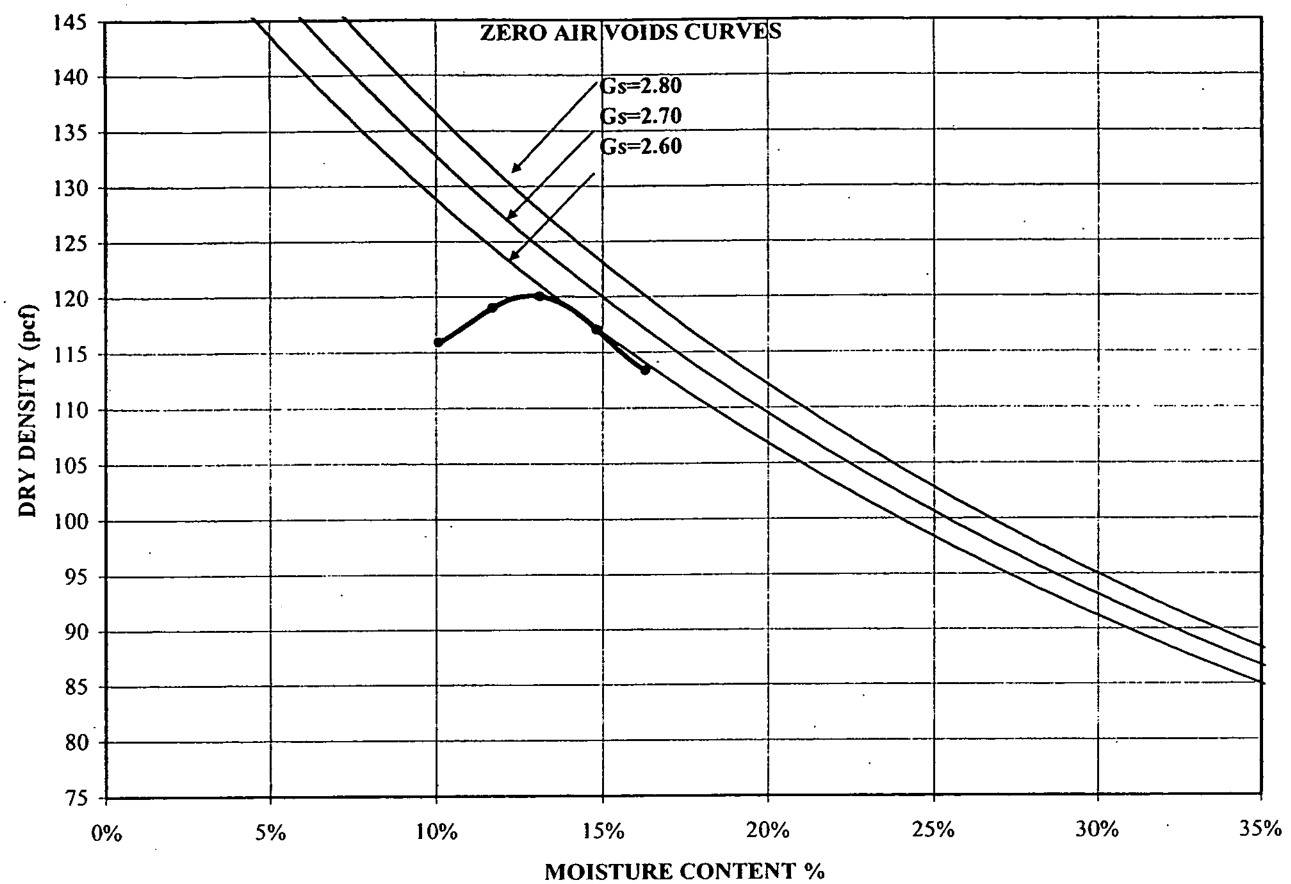
DESCRIPTION: Moderate yellowish brown

USCS: --

TECH	DT
DATE	5/10/2005
REVIEW	MB

184

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	120.0	Corrected Maximum Dry Density (pcf)	122.0
OPTIMUM MOISTURE (%)	12.9	Corrected Optimum Moisture (%)	12.2

SAMPLE ID	PSE-2
SAMPLE TYPE	Pail
SAMPLE DEPTH	-

LL	--
PL	--
PI	--
MC	0.00%

DESCRIPTION	Moderate yellowish brown
USCS	--

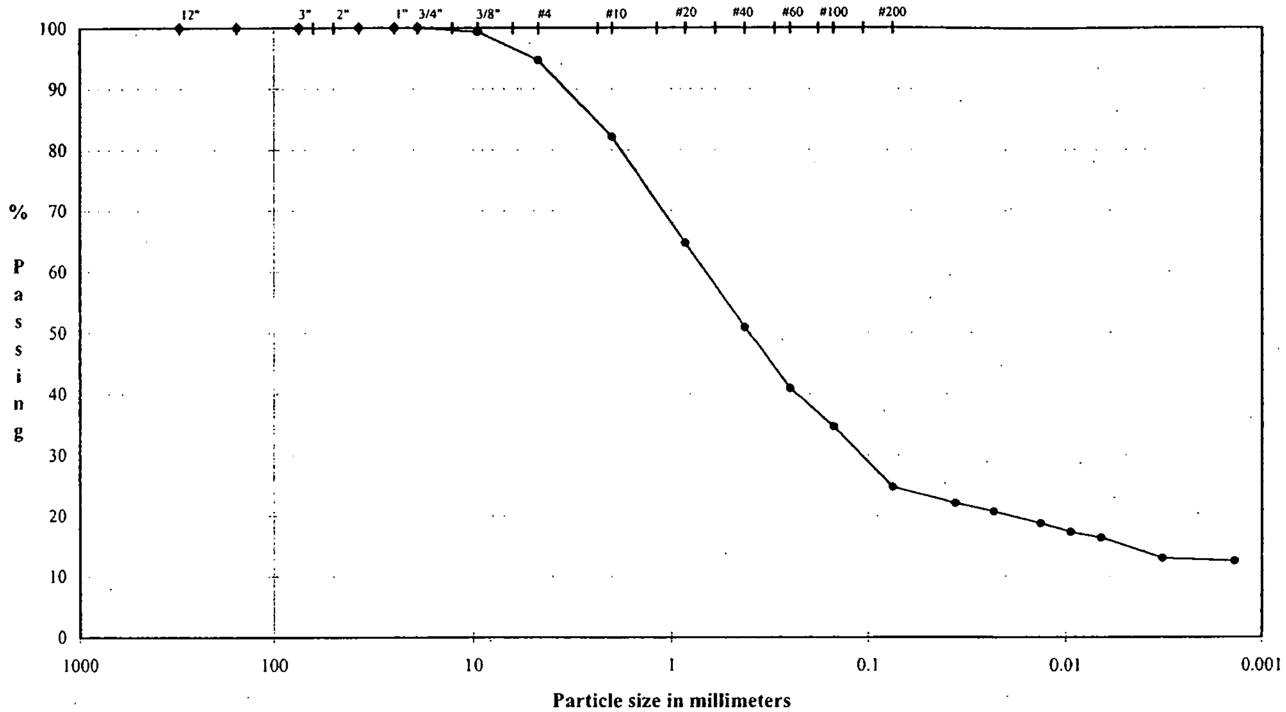
Kaiser Hill/Rocky Flats Field & Lab
053-2203-0001

TECH	MKS
DATE	5-13-05
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Kaiser Hill/Rocky Flats Field & Lab**
SAMPLE ID: **PSW-2** Depth (ft): -
TYPE: **Pail**



COBBLES	GRAVEL: Coarse	GRAVEL: Fine	SAND: Coarse	SAND: Medium	SAND: Fine	FINES: Silt or Clay

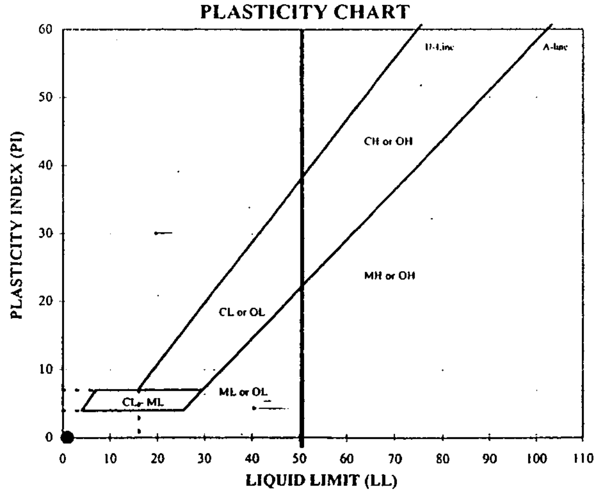
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
6.0"	154.2	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0	Coarse Gravel	0.00
0.75"	19.0	100.0		
0.375"	9.5	99.4		
#4	4.8	94.7	Fine Gravel	5.29
#10	2.00	82.2	Coarse Sand	12.53
#20	0.85	64.7		
#40	0.43	50.9	Medium Sand	31.32
#60	0.25	40.9		
#100	0.15	34.6		
#200	0.075	24.8	Fine Sand	26.11

Hydrometer Analysis

(mm)	%Finer		
0.036	22.1		
0.023	20.7		
0.013	18.8	Fines	
0.0094	17.3	Silt or Clay	24.75
0.0066	16.3		
0.0032	13.0		
0.0014	12.5		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	--	--	--	--

DESCRIPTION: Moderate brown

USCS: --

TECH	DS
DATE	5/12/2005
REVIEW	MB

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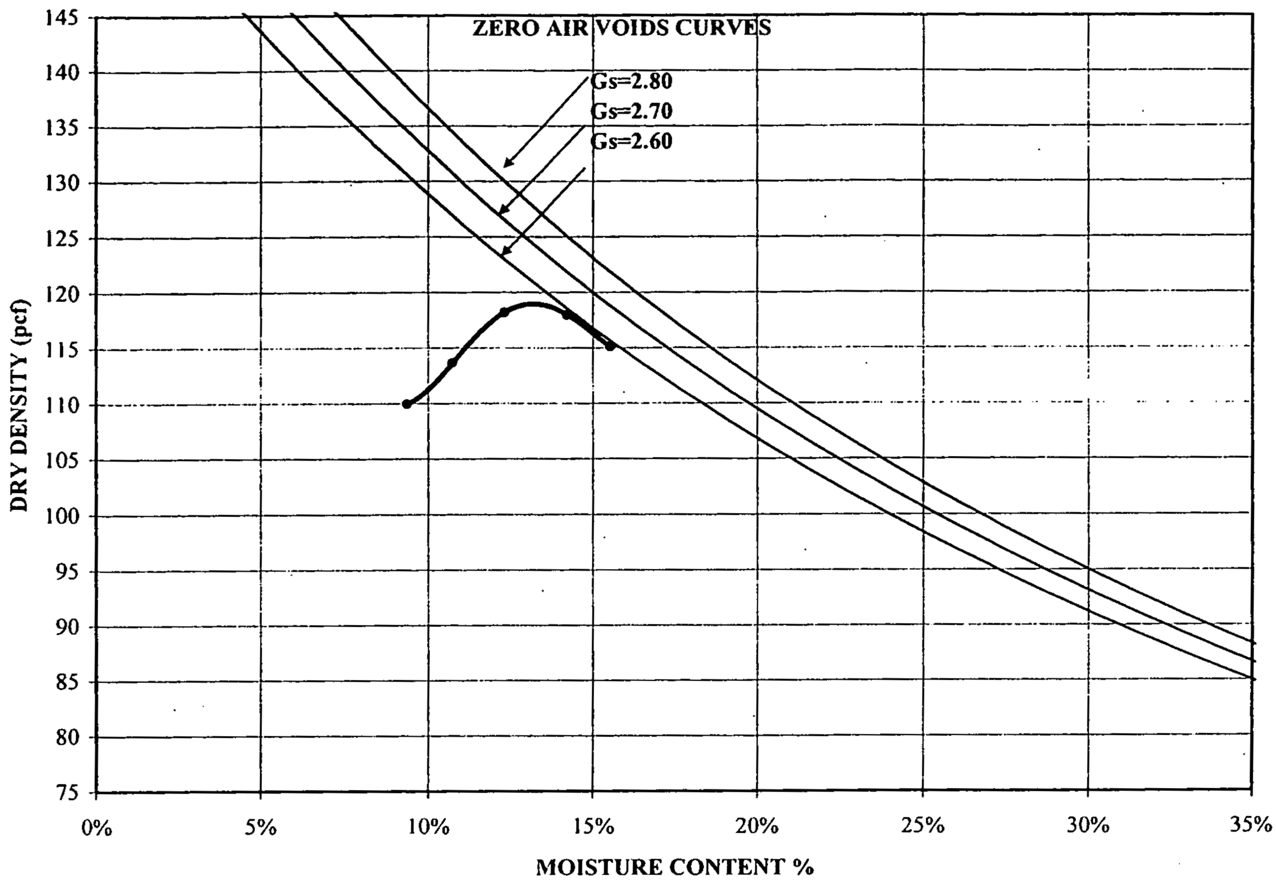
MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	118.9	Corrected Maximum Dry Density (pcf)	120.4
OPTIMUM MOISTURE (%)	13.2	Corrected Optimum Moisture (%)	12.7

SAMPLE ID	PSW-2
SAMPLE TYPE	Pail
SAMPLE DEPTH	-

LL	--
PL	--
PI	--
MC	0.0

DESCRIPTION	Moderate brown
USCS	–

Kaiser Hill/Rocky Flats Field & Lab
053-2203-0001

TECH	MKS
DATE	5-12-05
REVIEW	MB

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TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	TRANSMITTAL NO.: OLF-006 DATE: 5/11/05
To: Mike Keating (K-H) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200	**From:** Steven McQueary (Envirocon) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200
Specification Sec. No. General Project	**Project Title and Location:** Cover Original Landfill - Rocky Flats

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	QA/QC Resumes	3	Table 7.1	N/A	N/A

REMARKS

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary Steven L McQ
NAME AND SIGNATURE OF CONTRACTOR

- [x] APPROVED
- [ ] APPROVED AS CORRECTED
- [ ] NOT APPROVED
- [ ] REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

AUTHORITY	DATE

SITE QA MANAGER / DATE

JM Keating 5/17/05
RESPONSIBLE MANAGER DATE

Add Josh VanSanten

Section Description: General Project
Section Number: N/A
Paragraph Number: Table 7.1 QA/QC Plan
Description of Item: QA/QC Resumes
Transmittal Number: OLF-006

Golder Quality Control Resumes

- Quality Control Site Manager (QCSM) - Mark McClain, P.E., see attached resume
- Quality Control Personnel – Matthew Cashimer, Ronald P. DiDonato, and Michael Place, see attached resumes

Tetra Tech Quality Assurance Resumes

- Site Quality Assurance Managers (SQAMs) - John H. Rahe, P.E., see attached resume
- Construction Quality Assurance (CQA) Engineers – Bruce Marshall, Patrick Niedermeyer, Marshall A. Massaro, see attached resumes

Mark McClain, P.E.

Education BS, Urban and Environmental (Civil) Engineering, University of North Carolina, Charlotte
MS, Civil Engineering (Geotechnical), University of Colorado, Boulder

Affiliations Professional Engineer (Colorado, #24257, North Dakota #4764)
American Society of Civil Engineers
Solid Waste Association of North America

Experience

2000 to Present **Golder Associates Inc.** **Denver, Colorado**

Senior Project Manager to Associate

Manages and provides technical support to various solid waste facilities and hazardous waste cleanup sites throughout the western and midwest United States. Responsibilities include landfill construction quality assurance certification, coordinating the development and preparation of design and permitting documents for waste disposal facilities, CERCLA Remedial Designs and treatability studies, hazardous waste remediations and providing consulting support to clients on various regulatory and technical issues. Development of closure and post-closure plans for various landfill sites throughout Colorado and the western United States.

1991 to 2000 **Morrison Knudsen Corporation** **Denver, Colorado**

Technical Manager/Design Engineer

Engineering role on miscellaneous projects and proposals. Provided technical support for miscellaneous civil and environmental design and construction projects and proposals throughout the Midwest and Western United States.

Managed all technical aspects of the remediation development of the conceptual plan to remediate the Rocky Mountain Arsenal. Responsibilities involved developing a conceptual plan for remediation, sequencing projects, developing site-wide operating plans, preparing designs for and performing construction management on early start projects and preparing site-wide engineering and construction procedures. Primary contact for the Regulator Agencies on remediation activities including comment and dispute resolution.

Performed management and oversight of technical aspects of Shell's role at the Rocky Mountain Arsenal CERCLA site. Responsibilities involved coordinating Shell's role in development of the Record of Decision (ROD), management and oversight of designs for Removal Actions, the feasibility study, development of technical position papers on groundwater and remediation costs, and management of technical staff.

Mark McClain, P.E.

1989 to 1991 **Enecotech Inc.** **Denver, Colorado**

Corporate Remediation Manager

Developed and managed remediation program for 6 offices nationally. Set up engineering, bid solicitation and construction management, and quality assurance procedures for corporation. Supervised approximately 25 engineers and remediation design and implementation on a variety of uncontrolled hazardous waste and petroleum hydrocarbon sites nationwide. Oversaw overall completion of projects and Regulatory compliance including development of Operations and Maintenance Plans. Managed national accounts with several private Oil Companies.

1986 to 1988 **Environmental Science and Engineering** **Denver, Colorado**

Senior Engineer

Managed and developed the Remedial Investigations and Feasibility Studies/Corrective Measures Studies for large uncontrolled hazardous waste sites in the western United States. Responsibilities included management of approximately 6 engineers and the daily supervision of fieldwork and engineering deliverables. Designed and implemented remedial actions at several hazardous waste and petroleum hydrocarbon sites in the Western United States.

1979 to 1984 **Design Engineering**
(Subsidiary of Duke Power Co.) **Charlotte, North Carolina**

Project Engineer

Prepared various civil engineering designs including structural steel and reinforced concrete for power plants, and geotechnical engineering for dams, impoundments, and slurry walls. Performed construction quality assurance and quality control testing for a variety of civil engineering projects. Supported air quality compliance efforts for existing and new power plants including permitting, modeling, and monitoring. Prepared designs and operation plans for waste handling (coal ash and waste oil) facilities. Performed quality assurance audits of 150 person engineering organization.

Mark McClain, P.E.

PROJECT-RELATED EXPERIENCE-SOLID WASTE AND HAZARDOUS WASTE LANDFILLS

Abandoned CERCLA/RCRA Landfills at Fitzsimons Army Base Denver, Colorado
Managed and prepared the Final Corrective Measures Work Plan (Final Design) for three abandoned landfill remediations at the above site. Prepared all design drawings and specifications, assisted with bid package, and prepared supporting plans such as Closure/Post Closure Plans, CQA Plan and Construction Completion Plan. Conducted landfill gas monitoring and collection system design to prevent migration of landfill gases to adjacent areas.

Design and Permitting of Section 5 Landfill
Denver Arapahoe Disposal Site Denver, Colorado
Developed the Engineering Design and Operation Plan (EDOP) for a new landfill at the DADS site. Prepared all drawings and design narrative, calculations, closure/post-closure plans, waste screeing plans and provided interface with Regulators to obtain revised Certificate of Designation.

Design and Permitting of Colorado Springs Expansion Landfill
Colorado Springs Landfill Colorado Springs, Colorado
Developed the Engineering Design and Operation Plan (EDOP) for a new landfill at the Colorado Springs site. Prepared all drawings and design narrative, calculations, closure/post-closure plans, waste screeing plans and provided interface with Regulators to obtain revised Certificate of Designation.

Design and Permitting of Sedalia Landfill Sedalia, Colorado
Developed the Engineering Design and Operation Plan (EDOP) for a new C & D landfill at the Sedalia site. Prepared all drawings and design narrative, calculations, closure/post-closure plans, waste screeing plans and provided interface with Regulators and Douglas Planning Board and County Commissioners to obtain Certificate of Designation.

CERCLA/RCRA Hazardous Waste Impoundment Closure Salt Lake City, Utah
Assisted in the design of cap and closure/post closure plans for two hazardous waste impoundments at CERCLA/RCRA industrial site in Utah. One of the closures was conducted under CERCLA and the other RCRA.

Permit Application/Concept Design for Solid Waste Facility Kimball, Nebraska
Prepared permit application and concept design for a solid waste disposal facility in Kimball, Nebraska. Prepared Closure/Post-Closure Plans, CQA Plans and Operating Plans.

Inspection of Landfills Operations for Front Range
and North Weld Landfills Denver, Colorado
Performed quarterly audits at Northweld and Front Range Landfills on all aspects of operations, closure and monitoring.

Solid Waste Landfill Design Lincoln, Nebraska
Managed and prepared design for solid waste landfill facility in Nebraska. Prepared drawings, calculations, closure/post-closure plans and construction quality assurance plan.

Construction Quality Assurance for Solid Waste Landfills Colorado

Acted as certifying Engineer for construction quality assurance at solid waste landfills along Colorado Front Range including North Weld Landfill, Denver Arapahoe Disposal Site, Buffalo Ridge Landfill, Colorado Springs Landfill and Midway Landfill.

County Line Landfill **Denver, Colorado**

Redesign and monitoring of landfill gas collection system at new recreational facility constructed over closed landfill. Provided geotechnical support for new fields and recommendations to minimize water introduction to landfill.

Hazardous Waste Landfill Design **Denver, Colorado**

Manager of design of a 1.8 million cubic yard hazardous waste landfill in Western United States. Assisted in the Conceptual design and managed various technical aspects of the design including slope stability analysis, liner design, operational planning and Construction Quality Assurance Plan. Managed design support projects such as compatibility testing, interface shear testing, seismic analysis and test fill plots.

RCRA Equivalent Cover Design **Denver, Colorado**

Assisted in the development of soil-vegetative cover design concept for use as RCRA equivalent covers for over 200 acres at a large CERCLA site. Assisted in hydrologic/hydraulic modeling (UNSAT-H) of proposed cover designs and in design of test plots to field test designs.

Alternative Final Cover Design for Solid Waste Landfills **Colorado**

Development of demonstrations to permit Alternative Final Covers (AFCs) for six solid waste landfills in Colorado. Conducted on-site sampling, laboratory testing, and modeling to demonstrate equivalence to prototypical solid waste landfill design.

Hazardous Waste Landfill Leachate Treatment System Design **Denver, Colorado**

Assisted in the engineering, predominately conceptual, of a treatment system for leachate and storm water being removed from a large RCRA/CERCLA Hazardous Waste Landfill in the western United States. Responsibilities included predictions of wastewater quality and quantity, preparation of NPDES permit application, selection of treatment processes and engineering support during construction.

CERCLA Hazardous Waste Leachate Impoundment Design **Denver, Colorado**

Assisted in the design of 2 impoundments (3.5 million gallons) to store contaminated storm water and leachate at large CERCLA site in Western United States. Was involved in siting, estimation of wastewater volumes, selection of liner system and floating cover system and slope stability analyses.

Coal Ash Handling and Disposal **Charlotte, North Carolina**

Developed design and operating plans for Fly Ash and Bottom Ash disposal facilities at several coal-fired power plants in North Carolina and South Carolina

Hazardous Landfill Design **St. Louis, Missouri**

Provided technical support on geosynthetic liner design for Subtitle C Landfill at Department of Energy facility in Missouri.

Cover Design **Denver, Colorado**

Managed and assisted in design of a vegetative (RCRA-equivalent) cover for a hazardous waste site in western United States. Helped perform hydrologic/hydraulic modeling to support design, developed borrow plan to find suitable soils and prepared final specifications.

Mark McClain, P.E.

PROJECT-RELATED EXPERIENCE-ENVIRONMENTAL/ REMEDIATION

Air Modeling — **Charlotte, North Carolina**

Conducted air modeling to support the permitting of several new and existing coal-fired power plants. Conducted extensive evaluation of contribution of miscellaneous fugitive emission sources to particulates in nearby areas.

Title V Applications — **Nebraska, Oklahoma, Colorado**

Preparation of Title V Applications for solid waste sites in the western United States. Work included estimating PM-10 fugitive emissions and using Landgem Model to estimate NMOCs.

Tier II Landfill Gas Investigations — **Oklahoma, Colorado**

Performed sampling of landfill gas at several landfills to obtain accurate measurements of non-methane organic compounds (NMOCs). Used Landgem model to show that NMOC emissions were within regulatory limits.

Groundwater Intercept Trench — **Sheridan, Wyoming**

Designed groundwater intercept trench and treatment system for a private client at a petroleum hydrocarbon release site in northern Wyoming.

CERCLA RI/FS and RCRA Facilities Investigation and Corrective Measure Studies at Steel Mill in Western United States — **Orem, Utah**

Assisted in the investigation and corrective measures study of a large RCRA site. Responsibilities included conducting soil gas surveys, installing and monitoring wells, preparing concept designs for alternatives and analysis and report preparation.

Litigation Support — **Denver, Colorado**

Provided litigation support services to an international private client involving several hazardous waste sites nationally.

Technical and Litigation Support — **Sacramento, California**

Provided technical and litigation support to a national law firm on several environmental litigation projects. Cases ranged from UST projects to a release in a major river in the Northwest United States.

Preparation of Technical Position Papers — **Denver, Colorado**

Prepared technical position papers on issues such as groundwater migration, remediation costs and cost growth, and RCRA Equivalent Covers to support ROD negotiations on a large CERCLA site in Western United States.

Implementation Plan for Large CERCLA site — **Denver, Colorado**

Developed project sequencing, remediation schedule, site-wide operating plans for air quality, storm water control, traffic, borrow areas, and waste and waste water management for 14 year environmental cleanup.

Deep Soil Mixing Slurry Wall Design — **Denver, Colorado**

Project engineer for design of 9000 foot long deep soil mixing groundwater barrier and groundwater extraction system at large CERCLA site in Western United States. Managed, coordinated and assisted in the development of all plans, specifications and drawings. Coordinated comment resolution and project approval with regulatory agencies.

Oil Pipeline Contingency Plan — **Wyoming**

Assisted in the development of a contingency plan for a major oil pipeline in southern Wyoming for a national oil company.

Soil Stabilization Treability Study at CERCLA Site — **Denver, Colorado**

Project engineer for a treatability study to evaluate optimum stabilization mixes for soil contaminated with organic and inorganic contaminants at CERCLA Site.

Slurry Wall Design — **Denver, Colorado**

Prepared the Conceptual Design for a slurry wall at a refinery in Colorado. Prepared report, drawings, and preliminary specifications.

Manager of Remedial Investigation at Large CERCLA Site — **Denver, Colorado**

Prepared and managed implementation of a remedial investigation at a large CERCLA site in the Western United States. Managed preparation of all well installation and sampling plans, surface water monitoring plans. Supervised field activities and preparation of final reports.

Manager of Feasibility Study for Large CERCLA Site — **Denver, Colorado**

Supervised and assisted in preparation of a feasibility study for a large CERCLA site in western United States. Oversaw all screening of technologies, development and selection of alternatives, conceptual engineering, cost benefit analyses, and preparation of final report.

Dioxin Cleanup — **St. Louis Missouri**

Remediation design for private client at dioxin site in St. Louis. Managed all client interfaces and prepared drawings, plans and air-monitoring plan for conceptual design.

Containment System and Free-Product Recovery Systems — **Cheyenne, Wyoming**

Prepared design and supervised installation of a groundwater containment system and a series of free-product recovery wells for a private oil company at a refinery in Wyoming. Prepared and negotiated all required permit applications with the State of Wyoming. Also, supervised operations, maintenance, and environmental monitoring of systems.

Investigation, Design and Construction Management of Remediation Systems at Petroleum Sites — **CO, TX, MO, WY, MN**

Supervised investigation and design and construction of remediation systems at approximately 35 UST sites in Texas, Arkansas, Missouri, New Mexico, Colorado, Wyoming, and Minnesota for 4 major oil companies. Developed standard drawings, specifications and bid packages for extraction and treatment systems, soil venting systems and air sparging systems. Was primary point of contact with 3 of the clients.

Evaluation of Existing Groundwater Containment System — **Denver, Colorado**

Performed an evaluation of an existing groundwater containment system on a large CERCLA site that was failing to completely contain a groundwater contaminant plume. Evaluated existing slurry, extraction, recharge, and treatment systems. As a result of study, prepared a new design for recharge trenches to replace plugged recharge wells.

Mark McClain, P.E.

PROJECT-RELATEDEXPERIENCE-GEOTECHNICAL INVESTIGATIONS

Dam and Impoundment Design — **Charlotte, North Carolina**

Prepared drawings and specifications and conducted analysis for several dams and earthen impoundments.

Foundation Investigation and Design — **Denver, Colorado**

Conducted field investigation and prepared Foundation Design Report for sports field and building complex in Denver.

Forensic Investigation on Building with Swelling Soils — **Denver, Colorado**

Conducted investigation to determine causes of building damage at a commercial building located on swelling soils in Northeast Denver.

Forensic Investigation of Building in area of Swelling Soils and Steeply Dipping Bedrock — **Denver, Colorado**

Conducted field work and analyses to determine the causes of building movement at site in Southwest Denver. Conducted remedial actions to help limit future damage to the building.

Testing of Various Subgrade Products for Artificial Turf — **Denver, Colorado**

Perform laboratory testing on various subgrade products to assess their effectiveness underneath artificial turf fields.

Construction Quality Control for Highway Project — **Dinosaur, Colorado**

Managed project to conduct field and laboratory quality control testing for a new highway near Dinosaur, Colorado.

Haul Road Design — **Denver, Colorado**

Managed and assisted in performance of design of approximately 9 miles of haul roads for environmental cleanup projects. Developed traffic and loading estimates and developed specifications for underlying soil, sub-base and base course. Developed operational plan for haul road usage.

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Mark McClain, P.E.

PUBLICATIONS

Field test of potential RCRA-Equivalent Covers at the Rocky Mountain Arsenal, Colorado. May 1999. D. George Chadwick, Carl V. Mackey, Mark D. Ankeny, Mark E. McClain, and Louis M. Greer.

Performance Study of a Novel Vertical Groundwater Containment Barrier at Rocky Mountain Arsenal. March 2000. Mark McClain, Jeff Myers, Mike Winter, and Rich Lesser.

Development of a Conceptual Plan to Remediate the Rocky Mountain Arsenal. February 1997. Gary Anderson, Mark McClain.

Matthew Cashimer

Education B.S., Geological Engineering, Colorado School of Mines

Certifications
Troxler Nuclear Density Gauge and Radiation Safety Course
OSHA 40-Hour Hazmat Training Course
MSHA Surface and Underground Mining Course
Citizen of the United States of America
Citizen of Canada

Experience

8/2001 - Present **Golder Associates Inc.** **Denver, Colorado**
TITLE
Responsibilities include performing lab testing to ASTM or AASHTO standards efficiently, training of new employees, maintaining data base for sample storage, general building maintenance, data entry, and QA/QC for soil and geomembrane placement.

6/2001 – 7/2001 **Coors and Company** **Denver, Colorado**
TITLE
Responsibilities included stocking, cash register, packing and shipping, and customer service.

6/1997 – 8/2000 **Callie's Candy Kitchen** **Mountainhome, Pennsylvania**
TITLE
Responsibilities included stocking, cash register, packaging, cleaning, and building maintenance.

Matthew Cashimer

PROJECT RELATED EXPERIENCE

Cripple Creek and Victor Gold Mine **Victor, Colorado**
Construction Quality Assurance field technician. Observed placement of clay subgrade, deployment of geomembrane, welding of geomembrane, pressure testing, repairs, vacuum testing, trail seam testing, destructive testing, and placement of drain cover and final grading of drain cover.

Cripple Creek and Victor Gold Mine **Victor, Colorado**
CQA field technician. Observed placement of drain cover and final grading of drain cover.

Lone Tree Gold Mine **Battle Mountain, Nevada**
CQA lab technician. Operated the field lab for the site. Procured samples for testing and performed Proctors, Atterbergs, and sieves.

Ronald P. DiDonato

Education B.S., Engineering/Environmental Geology, University of Colorado, Denver, 1995

Certifications OSHA 40-Hour HAZWOPER Health and Safety Training with Current Refresher
OSHA 1910.120 (e) (4) Supervisor Training
OSHA Confined Space Entry Training
MSHA 8-Hour Health and Safety Training
Radiation Safety and Nuclear Gauge Operation
ACI Concrete Technician Level 1 Certification

Affiliations RMAG Member

Experience

1996 to Present **Golder Associates Inc.** **Denver, Colorado**

Project Geologist
Experience includes field oversight, personnel management, client development, monitoring, testing, sampling, and reporting earthwork, engineered materials, and geosynthetic components of construction projects.
Staff Geologist
Field experience includes monitoring, sampling, data collection, and testing of geosynthetic and soil components during construction of soil liner and cover systems. Geosynthetic experience includes deployment, welding, and non-destructive test monitoring, field testing of destructive samples, and record drawing mapping. Earthwork experience includes soil type, placement, and compaction monitoring, performing density testing and field index testing, and preparing daily field reports.
Laboratory Technician
Performed engineering soils testing including: moisture contents, Atterberg limits, Proctors, specific gravity, shrinkage limits, pinhole dispersion, grain size analysis, consolidation, and permeability using both the flexible wall and rigid wall methods.

1995-1996 **Denver Earth Resources Library** **Denver, Colorado**

Librarian Assistant
Compiled and sustained databases of well logs (hard copy, fiche, and tape), state guidebooks, periodicals and publications, and maps.

1993-1996 **Coors Ceramics** **Golden, Colorado**

Quality Control Technician
Followed blueprint specifications and measurement guidelines for electrical ceramic parts. Cleaned, inspected, and packaged ceramics.

1992-1993 **Goodson and Associates** **Golden, Colorado**

Engineering Technician
Performed field tests on concrete, asphalt, and soils. Operated survey and engineering test equipment. Also aided in laboratory work.

1991-1992 **Solution Gold Ltd.** **Golden and Central City, Colorado**

Plant Operator, Laboratory Technician

Ronald P. DiDonato

Responsible for maintenance and operation of a cyanide heap leach mine. Performed lab tests (pH, turbidity, hydrometer, spectrophotometer) of pumped water throughout the plant.

Ronald P. DiDonato

PROJECT RELATED EXPERIENCE

Cresson Gold Mine, Heap Leach Facility, 2004 — **Victor, Colorado**

Resident CQA Manager responsible for quality assurance services for construction of a 2,700,000 square foot leach pad expansion (Phase IVc) and Phase II/III TR extension. Responsibilities consisted management of approximately ten Golder staff, client and contractor construction meetings, staffing issues, underground remediation, soils testing, monitoring of engineered fill, drainage and detection construction, soil liner fill placement, drainage fill placement, geomembrane installation, delegate field and laboratory work, and certification report writing and review.

Homestake Mine Waste Pile Investigative Study, 2003 — **Lead, South Dakota**

Geological field engineer during the geotechnical investigation associated with remediating the waste groundwater and future grout curtain system construction along the toe of the Homestake waste pile in Lead, South Dakota. Performed lithologic logging, packer and slug testing of alluvium, schist, rhyollite, and phyllite. Approximately 18 borings were drilled to an average depth of 50 ft by the Hollow stem and HQ coring drilling method.

Fort Carson Landfill 5, 2003 — **Arapahoe County, Colorado**

CQA Monitor during investigative test pitting of loose lift cover liner of the Landfill number 5 high-permeability soil cover for the Fort Carson Military Base.

Midway Landfill, 2003 — **El Paso County, Colorado**

CQA Monitor during placement of loose lift cover liner of the Midway Landfill high-permeability soil cover for Waste Management.

Cresson Gold Mine, Heap Leach Facility, 2002-2003 — **Victor, Colorado**

Resident CQA Manager responsible for quality assurance services for construction of a 3,800,000 square foot pregnant solution storage pad and leach pad expansion (Phase IVb and IVb PSSA) and Lab extension. Responsibilities consisted management of approximately twelve Golder staff, client and contractor construction meetings, staffing issues, underground remediation, soils testing, monitoring of engineered fill and soil liner fill placement, drainage fill placement, geomembrane installation, delegate field and laboratory work, and certification report writing and review.

Cresson Gold Mine, Heap Leach Facility, 2001-2002 — **Victor, Colorado**

Resident CQA Lead Earthworks Monitor responsible for quality assurance services for construction of a 1,800,000 square foot leach pad expansion (Phase IVa) and Crusher System Expansion, ADR expansion, and Truck Shop Construction. Responsibilities consisted of underground remediation, soils and concrete testing, monitoring of engineered fill and soil liner fill placement, drainage fill placement, delegate field laboratory work, and certification report writing and review.

Phase II Sioux Falls Flood Control Project, 2001-2002 — **Sioux Falls, South Dakota**

Geological field engineer during the geotechnical investigation associated with repairing and raising the levee system along the Big Sioux River and Skunk Creek in Sioux Falls, South Dakota. Performed lithologic logging of till, glacial outwash and alluvium. 108 borings were drilled to an average depth of 55 ft by the Rotasonic drilling method.

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Ronald P. DiDonato

Adobe Buttes Landfill Phase III, 2000 — Delta County, Colorado
Resident CQA Monitor during construction of approximately 6-acres of clay liner over the expansion floor and side-slopes, leachate sump and drainage fill placement. Construction Manager responsible for installation of soil liner with tie-in to existing Phase II soil liner. Responsibilities included construction meetings, CQA, CQC, survey control and logistics. Soil sampling and testing protocols were implemented along with soil selection, borrow mixing table operations, and contractor direction for installation.

Rocky Mountain Arsenal, 1999-2000 — Commerce City, Colorado
Provided full-time CQA supervision, including coordinating and directing field and laboratory testing, nuclear density testing, monitoring of compacted clay liner deployment; performed required field laboratory testing during construction of the 12-acre, Cell 2, Hazardous Waste Landfill, and Leachate Perimeter Conveyance System. Worked directly for the CQAE and assisted in the coordination of the day to day construction activities in accordance with the project schedule, drawings, plans, and specifications. Contributed to the compiling of data and information for the preparation of the certification documents submitted to the client and regulatory agencies. Provided CQA monitoring and testing of M-1 pits, Basin F, and Lime Basin Treatability Study.

Cresson Gold Mine, Heap Leach Facility, 1999 — Victor, Colorado
Resident CQA Lead Earthworks Monitor responsible for quality assurance services for construction of a 1,800,000 square foot leach pad expansion (Phase III). Responsibilities consisted of soils testing, monitoring of structural fill and soil liner fill placement, drainage fill placement, delegate field laboratory work, and certification report writing and review.

Denver Arapahoe Disposal Site (DADS), 1998-1999 — Arapahoe County, Colorado
CQA Monitor during construction of 60-acres of cover liner over Section 31, Phases I and II side slopes and low-permeability soil berm for Asbestos Monofill II at the Denver Arapahoe Disposal Site.

Denver Arapahoe Disposal Site (DADS), 1998 — Arapahoe County, Colorado
CQA Monitor during construction of 200,000 cubic yard clay liner cell, modules 22-26, over Section 31.

San Louis Valley Sanitary Landfill, 1997 — Del Norte, Colorado
CQA Monitor during construction of Module 3, Phase I, structural fill and low permeability geotextile fabric.

North Weld Sanitary Landfill, 1997 — Weld County, Colorado
CQA Monitor during construction of Module 4, Phase I, low permeability clay liner, leachate trench, and drainage layer.

Cresson Gold Mine, Heap Leach Facility, 1996 — Victor, Colorado
Resident CQA Monitor responsible for quality assurance services for construction of a 5,000,000 square foot heap leach pad (Phase II). Project consisted of soils testing and monitoring during placement of rock fill, structural fill, drainage material, and low permeability soil liner.

Michael Place

Education: B.S. Geological Engineering, Colorado School of Mines, Golden, CO, 2001

Affiliations: EIT General Engineering , 2001

Certification: OSHA 40-Hour Hazwoper Certification
MSHA 24-Hour New Miner Certification
Nuclear Gauge Certification

Experience:

2000 to Present

Golder Associates Inc. — **Denver, Colorado**

Staff Engineer

Prepare project proposals by doing calculations and assisting in the design of various aspects of projects for the Civil Engineering group. Oversee CQA and CQC for field projects. Observe contractor activities, write daily reports, assist with weekly and monthly reports, and final construction completion reports. Conducted moisture density tests, slump tests on concrete, and observed leak tests on HDPE pipe.

9/2000 to 12/2001

Golder Associates Soils Laboratory — **Denver, Colorado**

Laboratory Technician

Conducted tests for soil compaction, grain size analysis, moisture content, hydrometer, specific gravity, and permeability tests.

PROJECT RELATED EXPERIENCE

Ira Holliman Tailings Impoundment — **McIntyre, Georgia**

Resident Engineer - Observed construction and implementation of the designed tailings impoundment dam for a kaolinite mine tailings project. Handled communications between the client and the Senior Engineer. Observed Contractor activities. Required to take moisture density tests on earth fill materials used in the impoundment and make sure all were within specifications, conducted slump tests on concrete and observed leak test on 32" HDPE pipe. Wrote daily reports and assisted with weekly and monthly reports for the preparation and completion of the final report to the client.

Cripple Creek and Victor Gold Mine — **Cripple Creek & Victor, Colorado**

Staff Geologic Engineer – Conducted Quality Assurance (QA) as a liner technician, laboratory technician, and lead earth works technician. Identified and remediated mine shafts and laterals. Conducted nuclear density tests for soil liner fill used as a base below the geomembrane. Observed the deployment of geomembrane, did pressure tests, vacuum tests, and seaming of panels for over five million square feet of liner placement.

PROFESSIONAL

EXPERTISE

JOHN H. RAHE, P.E.
Senior Engineer

EDUCATION AND SPECIAL TRAINING

B.S., Civil Engineering - Valparaiso University (1972)

Professional Engineer - Colorado, No. 14707 (1977)
Professional Engineer - Wyoming, No. 6131 (1991)
Professional Engineer - Idaho, No. 6984 (1992)
Professional Engineer - Montana, No. 11487PE (1994)
Professional Engineer - New Mexico, No. 12684 (1995)
Professional Engineer - Utah, No. 340480 (1997)
Professional Engineer - Illinois, No. 062-053064 (1999)
Professional Engineer - Missouri, No. E-2001015625 (2001)

Health and Safety Training, 40 hr. OHSA (1990 and subsequent refresher courses)
Wastewater Treatment with AIWPS and Constructed Wetlands, ASCE (1998)
Settlement and Consolidation Analyses, ASCE (1996)
NPDES Construction Storm water Permit Compliance ASCE (1994)
Designing with Geosynthetics, Drexel Research Institute (1990)
Quality Assurance and Control for Design and Construction, ASCE (1988)
Cavitation in Hydraulic Structures, ASCE (1984)
Various Civil and Structural Short Courses, ASCE

QUALIFICATIONS

Civil Engineering; Hazardous Waste Facility and Mine Remediation; and Dam and Hydraulic Structures Design for over 350 projects.

RELEVANT EXPERIENCE

Mine Remediation And Hazardous And Industrial Waste Facility Remedial Design

- Engineer of Record for remedial design at the former Murray Lead Smelter site, including an on-facility geomembrane-lined repository for containment of approximately 130,000 tons of arsenic-contaminated materials beneath a city street and parking lot, and smelter complex remedial design, including coordination of design with various site redevelopment activities and certification of all completed remedial construction at a Brownfield Site, Utah.

- Engineer of Record for design of closure plans for two tailings facilities, process areas, residential area remediation, mine waste rock pile, mine drainage control and mine adit plugging program, including certification of completed components, at the Triumph Mine site in central Idaho.

PROFESSIONAL
EXPERTISE

JOHN H. RAHE, P.E.
Senior Engineer

- Engineer of Record for a remedial design project at the Upper Blackfoot Mining Complex including three mine waste repositories, mine infiltration control, mine adit plugs, hybrid treatment system for discharge from two mines with conventional pretreatment and constructed wetland polishing including all ancillary facilities, and a zero discharge passive wetland treatment system, Montana.

- Engineer of Record for a remedial design project at several mine sites within the Bonanza Mining District including tailings closure/consolidation and repository design, flood control and stream channel rehabilitation design with aquatic/riparian habitat enhancements and mine discharge control including an 860-foot design head adit plug, run-on control and oxidation/sedimentation ponds, with certification of constructed components, Colorado.

- Senior Project Engineer for design of a remedial program at a tailings facility that experienced a previous failure, including design of all geotechnical and hydraulic remedial measures, flood water diversion and seep management control systems, Talache Mine, Idaho.

- Engineer of Record for design of a pilot demonstration project for alternative constructed wetland treatment systems at a CERCLA site including an initial surge pond, three types of subsurface-flow test cells and two types of surface-flow test cells with extensive monitoring systems, Montana; and for a hybrid pretreatment-wetland treatment system pilot project for mine drainage, northern Idaho.

- Engineer of Record for stream bank and channel remediation along the South Fork Coeur d'Alene River including stabilized levee and in-channel stabilization and habitat enhancement components, design of a large mine waste repository, and design of a system to divert and treat secondary effluent from a municipal wastewater treatment plant in a natural wetland, Idaho.

- Engineer of Record for design of a subsurface, hanging barrier wall at an industrial facility, for containment of a light non-aqueous phase liquid (LNAPL) material along the west bank of the Mississippi River, including LNAPL recovery system and bank stabilization measures, Missouri.

- Engineer of Record for design of a 1,400-foot head, 25-foot long concrete plug for control of discharge from a mine tunnel including rock grouting design, anchorage system and piping, pressure monitoring and control systems, Mt. Emmons Crested Butte, Colorado.

- Preparation and certification of Spill Prevention Control and Countermeasure (SPCC) Plans for a rental car facility at the Salt Lake International Airport Facility, Utah.

- Development of work plans and preliminary designs for the Bunker Hill CERCLA site FS and RD; Groundwater/Surface Water Collection and Diversion; Collected Water Wetlands including final design of a demonstration method treatment system; Smelter Complex closure; Floodway and Central Impoundment Area Closures, Idaho.

- Provided technical expertise on the inspection and certification of surface coatings and linings for tanks, storage and containment areas, and assessment of repairs at a hazardous waste treatment, storage and disposal (TSD) facility and review and certification of a subsurface investigation report for a secure landfill cell at the TSD facility, Colorado.

- Hazardous and industrial waste landfills, impoundments and groundwater extraction systems for CERCLA and RCRA sites; Utah, Ohio, Wyoming, New York, Florida, Colorado, Idaho and Texas.

- Mine remediation design including civil site work, flood control channels, groundwater extraction systems, temporary treatment facilities, mine adit bulkhead and shaft cover designs; Colorado.

- Expedited engineering evaluation/cost analysis (EE/CA) for the Colorado Tailings operable unit of the Silver Bow Creek/Butte Area Superfund site and conceptual design for feasibility study (FS) for the Butte Priority Soils Operable Unit (BPSOU) in Montana.

- Wastewater treatment facilities and contaminated groundwater treatment plant final designs; Colorado, Arizona, Oklahoma and Guam.

- CERCLA site feasibility studies (FS) and focused feasibility studies (FFS) for sites in Colorado and Idaho.

- Bioremediation land farm design for oily wastes and land farm closure design at a RCRA facility in Wyoming.

- Municipal solid waste (MSW) landfill designs, including active methane gas venting system designs and specifications; Colorado, Arizona and Illinois.

- Nuclear waste disposal site isolation and encapsulation design study, and cost/benefit analysis; Idaho.

Water Resources And General Civil Engineering

- Project Engineer for roller compacted concrete (RCC) dam design (264 feet high) for a water supply project including reinforced concrete intake structure, outlet works, spillway design including physical hydraulic modeling of an emergency spillway system design for over 100,000 cubic feet per second, dam joint design and grouting/maintenance adits, temporary stream diversions, access roads, reservoir and peripheral design; San Diego County, California.

- Project Engineer for design of an RCC dam (60 feet high) for secondary, emergency containment of leachate from a mine facility including an RCC foundation mat, dam stability analyses, overflow stepped spillway system, and evaluation of upstream lining systems, Morenci, Arizona.

- Project Engineer for earth dam rehabilitation design for an irrigation water supply facility including embankment raise and stabilization, outlet works and spillway design, near Kremmling, Colorado.

PROFESSIONAL
EXPERTISE

JOHN H. RAHE, P.E.
Senior Engineer

- Project Engineer for design of a large diversion dam for groundwater recharge system including analysis of various diversion dam alternatives such as conventional concrete gravity dam with various cutoff walls including cement-bentonite slurry walls, diaphragm wall and RCC dam and subsurface cutoff; design of the selected RCC dam alternative and reinforced concrete diversion facilities including fish screens and ladders, diversion canal and associated facilities, southern California.

- Staff and Project Engineer for tailings dam designs for various facilities including starter dam and raise designs including decant towers, spillways, peripheral flood diversion facilities and decant barge systems for various facilities in Missouri, Colorado and Alaska.

- Senior Project Engineer for the design of principal pipe spillway and emergency spillway systems at a large (5,400 acre) multiple unit tailings impoundment facility, White Pine, Michigan.

- Project Engineer for a 115-foot high water supply rock-fill dam design with concrete facing, including spillway and outlet works design, and design of a fish bypass system for a resort facility in Guam.

- Project Engineer for a rehabilitation design of a historic seawall including toe stabilization and void grouting programs, Fort Point Historic Site, San Francisco, California.

- Project Engineer for design of a multiple pipeline bridge crossing including a regulating pond and pumping system at a phosphate mine/industrial facility in central Florida.

- Feasibility study and conceptual design for a large earth dam and reservoir storage project for a multiple-use facility including spillway and outlet works system designs, reservoir relocations, access roads and recreational facility plans, South Platte River, Colorado

- Flood control diversion design, leachate basin, pumping, pipeline systems, decant systems, river stabilization, floodwall, mine railroad bridge design and construction inspection; Cyprus Baghdad, Arizona and Rico, Colorado.

- Staff and Project Engineer for heap leach project designs at gold mining projects including geomembrane-lined pads and ponds and water/flood control designs; Victor-Cripple Creek, Colorado and Nevada.

- Project Engineer for Offshore Runway Extension and Airport Expansion Design and cost estimate for $60 million job; Dutch Harbor, Unalaska, Alaska.

- Project Engineer for Wind Energy Project, site grading and drainage, foundations, access roads and control and maintenance buildings; southern California.

- Various senior planning and design reviews of civil and geotechnical projects for mill tailings and industrial facility developments and closures, various states.

JOHN H. RAHE, P.E.
Senior Engineer

- Pipeline route selections and assessments for industrial water supply in Wyoming, Montana, North Dakota and South Dakota.
- Pipeline, tank and industrial equipment settlement analyses and remedial design at a power plant constructed over collapsible soils, Utah.
- Hydroelectric feasibility study, Wyoming; and water supply reservoir yield analysis, spillway studies and preliminary design of dams, Alaska, New Mexico and Colorado.
- Design and contract documents for large irrigation, drainage, pumped storage, hydroelectric, and water supply projects of up to 21,000 cubic feet per second, Arizona, California, Colorado, Nevada, Washington, and Singapore.
- Research in water quality - heavy metal removal and desalination techniques, Colorado and Arizona.
- Construction inspection - canals, pipelines, geothermal, and desalination test facilities, and construction cost estimating for various projects, Arizona and California.
- Technical review of major earth dam failure, Idaho.
- Various civil site drainage and facility structural design modifications and certifications for residential and commercial facilities in Colorado.
- Planning, layout, design, construction and management of a number of water supply and bridge projects for rural communities, Ecuador.
- Volunteered civil engineering services for planning and design of various hospitals, schools, and orphanages including water and wastewater systems, and foundation designs in developing countries; Belize, Bolivia, Haiti, Honduras, India, Kenya and Papua New Guinea.

PROFESSIONAL ORGANIZATIONS / ASSOCIATIONS

American Society of Civil Engineers
Engineering Ministries International (eMi; water resource design assistance for orphanages, hospitals and schools in developing countries); Denver Area Representative

PUBLICATIONS / PRESENTATIONS

"Encapsulating Contaminated Soil - A Geomembrane-Lined Repository Contains Arsenic-Contaminated Soil Beneath a Street in Utah", Geotechnical Fabrics Report, April, 2002.

PROFESSIONAL
EXPERTISE

JOHN H. RAHE, P.E.
Senior Engineer

"Design and Implementation of a Spatially-Constrained, Subsurface-Flow Constructed Wetlands for Treatment of Heavy Metals at an Inactive Mine Site in the Intermountain West: Project Hindsight", Wetlands Conference, 2000, Co-author.

"Wetlands Treat Mine Runoff," Civil Engineering, American Society of Civil Engineers, January, 1999, Co-author.

"Design and Optimization of the Mike Horse Mine, Montana, Wetland Treatment System," ASCE Wetlands Engineering & River Restoration Conference, 1998, Co-author.

"A Case History of Tailings Consolidation and Closure at the Bonanza Mining District;" Tailings and Mine Waste '97, Colorado State University, 1997, Co-author.

"Design and Construction of Lower Chase Creek Dam," Roller Compacted Concrete II, ASCE, 1988, Co-author.

"Development of Design Criteria and Final Design of Hydraulic Structures for Pamo Dam;" Design of Hydraulic Structures, Colorado State University, 1987, Co-author.

BRUCE T. MARSHALL, P.G.
Environmental Geochemist/Hydrologist/Project Manager

EDUCATION AND SPECIAL TRAINING

M.S., Environmental Sciences, University of Virginia, 1985
B.S., Geology, University of Maryland, 1980

REGISTRATIONS / CERTIFICATIONS

Certified Professional Geologist, Virginia No. 762
Professional Geologist, Wyoming No. 161
Certified OSHA Hazardous Waste Site Worker and Supervisor
Mine Safety and Health Training

QUALIFICATIONS

Mr. Marshall's academic background and professional experience has focused on the characterization of the physical and anthropomorphic processes impacting water resources. He has extensive experience quantifying point and non-point source contaminant loading on large-scale, basin-wide projects. This work has required a thorough understanding of surface water-groundwater interaction and environmental geochemistry. Mr. Marshall has applied this watershed experience to environmental and water resources projects that evaluate the quality and quantity of surface water and groundwater supplies available for aquatic life, agricultural, and water supply uses.

Mr. Marshall has participated in numerous environmental projects throughout the Western U.S. and Alaska. This experience includes: groundwater, surface water, lacustrine, estuarine, soil, and sediment contamination investigations; design, implementation, and evaluation of vadose zone, groundwater and surface water monitoring programs for CERCLA sites and RCRA Subtitle C T/S/D facilities; geophysical log interpretation, design, and construction of monitoring wells; tracer studies; preparation of remedial investigation/ feasibility study (RI/FS) documents under CERCLA; preparation of environmental impact assessments and permit documents to support mining operations; performance of Natural Resource Damage Assessments (NRDA's); preparation of Corrective Action Plans; NPDES permitting; TMDL assessments; evaluation of natural gas migration from underground storage reservoirs; assessment of migration of brine and ash impacted water from surface impoundments using stable isotopes; reactive transport modeling to assess the effectiveness of remedial alternatives and to establish surface water action levels; and database development.

In the area of water resources, including water rights, Mr. Marshall has: assessed the suitability of municipal effluent for use as an irrigation supply for golf course turfgrass; evaluated the use of groundwater as a raw water supply source for commercial use, including modeling of a well field and evaluation of water quality for potential use limitations; evaluated the value of groundwater rights for pre-213 wells; constructed models simulating reservoir in- and outflow; constructed computer-based models of river systems to assess the potential impact of surface water diversions and exchange programs on downstream water quality; evaluated the quantity, timing, and quality of groundwater return flows to river systems derived from lawn irrigation; evaluated stream depletions and

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BRUCE T. MARSHALL, P.G.
Environmental Geochemist/Hydrologist/Project Manager

augmentation requirements due to groundwater pumping; and assessed the viability of conjunctive use and groundwater recharge plans for municipalities and agricultural users.

RELEVANT EXPERIENCE

Environmental Analysis

- **Colorado Clean Watershed Needs Survey, Colorado Department of Public Health and Environment, Water Quality Control Division.** Serving as the Project Manager to identify and document non-point source needs (specifically mining and urban runoff) for reporting to Congress through the 2004 Clean Watershed Needs Survey.

- **Little James Creek, U.S. Environmental Protection Agency, Boulder County Colorado.** Serving as the Project Manager for a feasibility analysis evaluating abandoned mine waste pile capping/removal, open pit closure, and adit plugging/water treatment. Project is being performed concurrent with TMDL study and in cooperation with the USFS and Boulder County Parks and Open Space.

- **Clear Creek/Central City Superfund Site RI/FS, Colorado Department of Public Health and Environment, Gilpin and Clear Creek Counties, Colorado.** Served as the Project Manager for the OU4 Remedial Investigation and Feasibility Study. Water from Clear Creek is used for drinking water, agriculture, industry, and recreation in the Denver Metropolitan area and Colorado Front Range. The project quantified the point and non-point contaminant loading sources related to historical mining in the North Clear Creek basin, and developed a series of remedial alternatives to reduce the loadings from these sources. The goals of the project are to protect aquatic life and drinking water supplies in North Clear Creek and in the main stem Clear Creek downstream of the confluence.

- **Summitville Mine Superfund Site RI/FS, Colorado Department of Public Health and Environment, San Juan Mountains, Colorado.** Served as Project Manager for the Site-Wide Remedial Investigation and Feasibility Study. The site is located above 11,500 feet in the San Juan Mountains of Southern Colorado. Releases of metals and cyanide impacted the Alamosa River watershed below the mine, including an 8,500 acre-foot reservoir 17 miles downstream of the mine and the agricultural community served by the reservoir. Investigations performed included: geochemical evaluation of mine pool chemistry during a draw down test; sediment sampling including leaching studies and electron microprobe analysis; groundwater and surface water monitoring including the operation of six gaging stations providing real-time stream flow and chemistry data to the world wide web via satellite links; reactive transport modeling to evaluate the relative effectiveness of various remedial alternatives and to establish surface water action levels; evaluation of passive treatment technologies including, successive-alkalinity-producing systems (SAPS), Aquifix systems, and zeolites; metals content and nutritional quality of macroinvertebrates; acute and chronic fish toxicity studies; and snow course surveys.

PROFESSIONAL
EXPERTISE

BRUCE T. MARSHALL, P.G.
Environmental Geochemist/Hydrologist/Project Manager

- **Blackbird Mine, U.S. Forest Service, Lemhi County, Idaho.** Performed surface water studies to assess nature and extent of metals contamination from this copper and cobalt mine in support of a NRDA suit. Included geochemical modeling and mass-balance modeling of several watersheds. Evaluated metal distribution and mobility in stream sediments using sequential extraction techniques and the electron microprobe. Evaluated the long-term O&M costs to operate the final remedy in support of Consent Decree negotiations.

- **Bunker Hill Mine RI/FS, Pintlar Corporation, Northern Idaho.** Managed the surface water and groundwater monitoring programs at this large mining/smelting CERCLA site. The programs were key to the assessment of the relative contribution of point and non-point metal loading sources to the South Fork of the Coeur d'Alene River, which allowed for the design of remedial alternatives. Used lead isotopes to assess the relative contributions from the lead smelter and the mine tailings to allocate funding among PRPs for residential yard remediation costs. Assisted in the preliminary design of proposed subsurface flow constructed wetland systems for passive treatment of metals.

- **Alcoa Point Comfort Operations, Alcoa, Point Comfort, Texas.** Authored hydrogeology section for the Site Characterization Report of aluminum smelter and chlor-alkali cell operations. Supervised combined groundwater, surface water, and impoundment sampling project. Evaluated mercury loading rates to the marine environment.

- **RCRA Hazardous Waste Treatment, Storage, and Disposal Facility, Highway 36 Land Development Company, Deer Trail, Colorado.** Project Manager for the comprehensive background groundwater and surface water quality data evaluations, quarterly groundwater monitoring data evaluations, and annual groundwater monitoring data evaluations. This project included extensive data validation and statistical evaluation of analytical data, including the use of multivariate statistical analysis to minimize the number of analytes in the monitoring program.

- **RCRA Hazardous Waste Treatment, Storage, and Disposal Facility, International Technologies Corporation and Laidlaw Environmental Services, Inc., Bakersfield, California.** Field Supervisor for the design and installation of vadose zone and groundwater monitoring systems. Project Manager evaluating statistical exceedances in the groundwater monitoring program. Using geochemical modeling and revised statistical procedures, successfully demonstrated that the statistical exceedances were the result of spatial variability and/or inappropriate statistical evaluation methods.

- **Comanche Peak Nuclear Power Plant, TU Electric Company, Central Texas.** Conducted remedial investigation of seven industrial landfill cells. Included the design and installation of groundwater and methane monitoring systems, and the selective excavation and characterization of wastes. Oversaw the removal of one cell.

- **South Platte Reservoir Development Project, Centennial Water and Sanitation District, Littleton, Colorado.** Authored the Corrective Action Plan to excavate construction landfills and remove residual organic contamination at this former gravel mine. The mine is being converted into a raw water storage facility.

- **Belridge Fields, Shell Western Exploration and Production, Inc., San Joaquin Valley, California.** Evaluated the nature and extent of groundwater contamination resulting from seepage from ponds storing saline oil field waters. Utilized inorganic, organic, and stable isotopic data to distinguish impacted waters from non-impacted waters.

- **TU Electric Company, Various Power Plants, Texas.** Performed hydrogeologic investigations at ash handling and disposal areas. Assessed nature and extent of contamination using inorganic and stable isotopic data. Developed remedial options.

- **Martin Lake Lignite Mine, Texas Utilities Mining Company, Longview Texas**. Permit renewal of a 26,000 acre open-pit lignite mine. Field work included the drilling and logging of several thousand feet of core, geophysical logging of test holes, drilling and installation of 100 monitoring wells and piezometers, performance of aquifer tests, and collection of ground- and surface water samples. Evaluation included analysis of aquifer test data, groundwater and surface water quality data, and determination of overburden suitability as top soil.

- **Geneva Pharmaceuticals, Inc., Broomfield, Colorado**. Performed hydrogeological investigations to assess nature and extent of groundwater contamination by chlorinated solvents from adjacent facility. Co-authored No Action Petition under Colorado's Voluntary Cleanup Program.

- **Tererro Mine, Pecos, New Mexico.** Served as Task Leader for the evaluation of surface water and groundwater geochemistry for the Natural Resource Damage Assessment.

- **Cerro Grande Fire Assistance Act Damage Assessment, New Mexico**. Served as the lead geochemist for the investigation of contaminant transport from the Los Alamos Laboratory to the San Ildefanso and Santa Clara Pueblos.

Water Resources/Water Rights

- **Leyden Natural Gas Storage Facility, Xcel Energy, Leyden, Colorado.** Oversaw the drilling and construction of deep Laramie-Fox Hills Formation wells. Sampled groundwater and soil gas for methane and a variety of isotopes to evaluate the integrity of the storage facility. Evaluated the value of groundwater rights for pre-213 wells.

- **Pueblo Municipal Airport Raw Water Feasibility Study, Board of Water Works of Pueblo, Colorado.** Part of a team that evaluated the feasibility of using groundwater as a raw water supply source for the Pueblo Municipal Airport service area. Responsibilities included the modeling of a potential well field in the Arkansas River alluvium and assessment of the produced water quality for limits on potential usage.

- **Augmentation Plan for City of Pueblo Wells, City of Pueblo Wastewater Department, Colorado.** Managed and performed all the analysis on this project that quantified the volume and timing of stream depletions due to the operation of three wells. Developed an accounting system to determine the augmentation water obligations.

- **Groundwater Recharge Plans, Prairie Ditch and San Luis Valley Canal Companies, San Luis Valley, Colorado.** Evaluated use of historical direct surface water diversions to recharge unconfined aquifer in the Closed Basin. Principal author on report describing the historical location of the Groundwater Divide, which separates the Closed Basin from the Rio Grande River alluvial groundwater flow system.

- **South Park Conjunctive Use Project, City of Aurora, South Park, Colorado.** Utilized Carbon-14, tritium, and stable isotopes to age data groundwater and delineate groundwater recharge pathways. Synthesized historical stream flow records by developing mathematical relationships with regional, long-term flow gaging stations.

- **Central City Water Rights, Central City, Colorado.** Synthesized historical stream flow records by developing mathematical relationships with regional, long-term flow gaging stations. Based on synthesized flow records, evaluated the availability of water for appropriation by direct flow, storage and exchange at several points of diversion.

- **Effluent Water Reuse, Proposed Junior PGA Golf Course, Board of Water Works of Pueblo, Colorado.** Evaluated the suitability of using treated municipal effluent for irrigation of turfgrass on a proposed golf course. Water quality considerations included; salinity, sodium adsorption ratio, specific ion toxicity problems, nutrient loading, and suspended solids content. Performed geochemical modeling to assess the potential for precipitation of carbonate minerals in the soils.

Expert Experience

- **Clayton Curphy v. Microsemi Corporation, Siemens Components, Inc., FMC Corporation and Geneva Pharmaceuticals, Inc., Case No. 94CW167.** Prepared affidavit describing the nature and extent of groundwater contamination resulting from the release of chlorinated solvents to the subsurface.

- **Mathews, et al., v. Dow Chemical Company, et al., Case No. 96WY1368CB.** Prepared affidavit describing the nature and extent of groundwater contamination, accuracy and precision of laboratory analytical data, applicability of water quality standards, and divisibility of cleanup costs resulting from the release of chlorinated solvents to the subsurface.

BRUCE T. MARSHALL, P.G.
Environmental Geochemist/Hydrologist/Project Manager

- **Application for Change of Water Rights, Division Three Water Court, Case No. 96CW45.** Prepared affidavit describing the impact of pumping an agricultural water supply well on groundwater levels in the unconfined aquifer of the San Luis Valley. Testified in deposition regarding the hydrogeology of the Closed Basin of the San Luis Valley.

- **Application for Change of Water Rights, Division Three Water Court, Case No. 96CW46.** Prepared affidavit describing the impact of pumping an agricultural water supply well on groundwater levels in the unconfined aquifer of the San Luis Valley.

- **United States of America and the State of Colorado v. Robert Friedland, Case No. 96-N1213.** Provided technical support to the Colorado Office of the Attorney General and the U.S. Department of Justice. Attended depositions, reviewed expert reports, and prepared expert reports describing the fate and transport of contaminants downstream of the Summitville Mine Superfund Site.

- **Brown Group Retail, Inc. v. IBM, et al., Case No. 01WY0917(AJ).** Provided technical support in the areas of contaminant fate and transport in groundwater, and the divisibility of temporally and spatially overlapping solvent plumes.

PROFESSIONAL ORGANIZATIONS / ASSOCIATIONS

Member, International Association of Geochemistry and Cosmochemistry
Member, Association of Ground Water Scientists and Engineers, NGWA
Member, American Water Resources Association
Member, Engineers Without Borders

PUBLICATIONS

Marshall, B.T., and Herman, J.S., 1986, "*Trace Element Distribution in the Soils Above Deeply Weathered Pegmatites, Virginia, U.S.A.: Implications for Exploration,*" Applied Geochemistry, Vol. 1, pp. 681-690.

McCulley, B.L., and Marshall, B.T., 1990, "*Distinction of Naturally-Occurring and Industry-Related Contaminants in Ground Water Monitoring Systems,*" Colorado Hazardous Waste Management Society, Fourth Annual Conference and Exhibition Proceedings, October.

Marshall, B.T. and Drexel, R.T., 2001, "*Terrace Reservoir Recovery,*" Colorado Lake and Reservoir Management Association, October.

Cox, T.J., Marshall, B.T., and Drexel, R.T., 2002, "*Monitoring and Management of Groundwater Stored in Underground Mine Workings,*" Hardrock Mining 2002, May.

BRUCE T. MARSHALL, P.G.
Environmental Geochemist/Hydrologist/Project Manager

Medine, A.J. and Marshall, B.T., 2002, "*Modeling the Effectiveness of Remedial Alternatives at the Summitville Mine Superfund Site on Water Quality of the Alamosa River and Terrace Reservoir*," Hardrock Mining 2002, May.

Hesemann, T., and Marshall, B.T., 2003, "*Measuring the Effectiveness of Mine Site Remediation*," Association of Engineering Geologists 46th Annual Meeting, September.

PATRICK NIEDERMEYER, E.I.T.
Civil Engineer

EDUCATION AND SPECIAL TRAINING

B.S., Civil Engineering – Environmental Focus, University of Colorado, 2004

REGISTRATIONS / CERTIFICATIONS

Engineer in Training - Colorado
Certified Hazardous Waste Site Worker
Nuclear Density Testing Certified

QUALIFICATIONS

Mr. Niedermeyer has experience in supervising geotechnical investigations for several dam and gravel pit reservoir projects including the Camenish Pit, the Tucson pit, and Hartsel Springs dam and reservoir. He is experienced in geotechnical quality control testing for soils and is currently certified for using the nuclear density gage.

RELEVANT EXPERIENCE

- **Rocky Flats Environmental Technology Site – Surface Water Group**. Performed inspections required by the site National Pollution Discharge Elimination permit. Developed annual compliance reports, site water quality contaminant profiles, and environmental stewardship scenario evaluations. Developed sediment and erosion control measures for pollution prevention.

- **Tucson Gravel Pit Reservoir**. Quality control testing and construction observation of internal slope liner.

- **Camenish Gravel Pit Reservoir.** Analysis and interpretation of geotechnical data, estimates of material quantities for slope liner and reservoir capacities.

- **Hartsel Springs Dam and Reservoir.** Supervisor of field geotechnical investigations including geotechnical drilling, packer permeability testing and compilation and analysis of data.

PROFESSIONAL ORGANIZATIONS / ASSOCIATIONS

Member, American Society of Civil Engineers

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PROFESSIONAL

EXPERTISE

MARSHALL A. MASSARO
Staff Environmental Scientist

EDUCATION AND SPECIAL TRAINING

B.S., Watershed Science, Colorado State University, 1999
Minor, Geology, Colorado State University, 1999

CERTIFICATIONS

Radiological Worker Level II Training (RFETS)
Certified OSHA Hazardous Waste Site Worker
Emergency Medical Technician-Basic (EMT-B) Certified
Nuclear Density Testing Certified

QUALIFICATIONS

Mr. Massaro has been an environmental scientist on a variety of environmental and geotechnical projects. These projects have included water quality sampling and analysis, groundwater and surface water contaminant modeling, installation of flumes to gauge surface water flow, water rights and water quantity evaluations, gravel resource, design and construction of monitoring wells, and other geotechnical investigations, gravel mine permitting; well construction and design; tracer studies; and construction quality assurance/quality control (QA/QC). His experience on these projects ranges from oversight of field sampling events, municipal water rights analyses, topographical and aerial map generation, reservoir construction, cost estimating, and other environmental related services.

Marshall also has experience in geotechnical investigations for several dam and reservoir studies and has been responsible for geotechnical quality control work on several construction projects. He is trained and experienced in density testing of soils using the nuclear density gage and is currently certified.

RELEVANT EXPERIENCE

Water Quality Experience

- **Summitville Mine Superfund Site, San Juan Mountains, Colorado.** Field scientist for the sampling of surface water, ground water, sediment, and aquatic life impacted by mining activities. Conducted heavy metal loading analyses for impacted surface water supplies to compare with aquatic life standards.

- **California Gulch National Priority List (NPL) Site, Leadville, Colorado.** Field scientist for the sampling of surface water and groundwater impacted by mining activities. Conducted heavy metal loading analyses for impacted surface water supplies to compare with aquatic life standards.

- **Bonanza Mining Region, Bonanza, Colorado.** Field scientist for the sampling of surface water and groundwater impacted by mining activities.

Water Rights Experience

- **Bedrock Groundwater Quantity Investigations, Thornton, Colorado.** Responsible for the quantification of groundwater resources located beneath the city limits of Thornton, CO within the Lower Arapahoe and Laramie-Foxhills bedrock aquifers.

Geotechnical Experience

- **Present Landfill Cap Construction Quality Assurance, Rocky Flats Environmental Technology Site, Golden, Colorado.** Responsible for observing and auditing the methods, procedures, results and testing equipment during construction of geosynthetic composite cover, perimeter ditches and seep passive treatment system.

- **Hazeltine and Tucson South Gravel Mines, Front Range, Colorado.** Responsible for the geotechnical investigations relating to the design of slurry walls and gravel resource quantifications

- **Bernhardt, Tucson, and 83rd Avenue Slurry Walls, Front Range, Colorado.** QA/QC specialist responsible for the proper construction of reservoir liners (slurry walls) surrounding proposed gravel mines.

JOSHUA R. VALENTINE
Engineering Technician

EDUCATION AND SPECIAL TRAINING

B.S., Colorado State University, 1995

REGISTRATIONS / CERTIFICATIONS

Radiological Worker Level II Training (RFETS)
Certified OSHA Hazardous Waste Site Worker
Certification of Completion, Nuclear Gauge
Western Alliance for Quality Transportation Construction
Laboratory for Certification of Asphalt Technicians (LabCAT)
American Concrete Institute

QUALIFICATIONS

Josh has more than 10 years of experience in geotechnical and construction quality control testing. He is qualified for concrete field and laboratory testing, asphalt field and laboratory testing; geotechnical field and laboratory testing, construction observation of piers, fill control and density testing, reinforcing steel and welding inspection, geocomposite clay liner observation, and water line/sewer line inspection.

RELEVANT EXPERIENCE

- Present Landfill, Rocky Flats Environmental Technology Site
- Hayden Meadows Reservoir, Louisville, Colorado
- Arapahoe Mine Cleanup, Leadville, Colorado
- Expansion of 72nd Avenue - Phases I, II, and III, Arvada, Colorado
- Flatirons Office Complex, Boulder, Colorado
- Ballard Pond, Longmont, Colorado
- Spring Valley Golf Course, Longmont, Colorado
- Water Treatment Plant, Arvada, Colorado
- Promtech Office and Storage, Louisville, Colorado
- City of Lafayette, Lafayette, Colorado
- Subdivision Developments, Parker, Colorado
- Lake County Reservoir, Leadville, Colorado
- Asphalt, Concrete and Reinforcing Steel

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TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	TRANSMITTAL NO.: OLF-007 DATE: 5-18-05
To: MIKE KEATING K-H T130F RFETS 10808 HWY 93, UNIT B, GOLDEN CO. 80403	From: STEVEN MCQUEARY (ENVIROCON) 130J RFETS 10808 HWY 93, UNIT B, GOLDEN, CO 80403
Specification Sec. No. 2200	Project Title and Location: COVER ORIGINAL ~~FILL~~ LANDFILL - ROCKY FLATS

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	SUPPLIERS SIEVE ANALYSIS FOR DRAIN ROCK	3	2.01 B	N/A	N/A

REMARKS

FIRST SAMPLE FOR 1/~~65,000~~ 6,500 cyds FROM SUPPLIER

OK
COAE TK

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

STEVEN MCQUEARY
NAME AND SIGNATURE OF CONTRACTOR

☒ APPROVED
☐ APPROVED AS CORRECTED
☐ NOT APPROVED
☐ REVISE AND RESUBMIT

5/19/05
SITE QA MANAGER / DATE

5/18/05
RESPONSIBLE MANAGER DATE

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

NA[ME]	AUTHORITY	DATE

CENTENNIAL AGGREGATES

SIEVE ANALYSIS

Product Name : Unwashed Aggregate 1.5"

Plant / Supplier / Location : Centennial Pit / Hwy 93

Sample ID No.: 93 Date Sampled: 5/17/05

Test Procedures : ASTM C136, C702, D75 Tested By : Jesse Mohler

Sample Dry Weight (g) : 17668.3

			Results	Specs	
Sieve Size	Weight, (g) Retained Cummulative	Percent, % Retained Cummulative	Percent % Passing Cummulative	CDOT No.4	
3"					
2"	0.0	0.0	**100**	100	
1 1/2"	536.0	3.0	**97**	90-100	
1"	9896.5	56.0	**44**	20-55	
3/4"	15803.5	89.4	**11**	0-15	
1/2"	16903.8	95.7	**4**		
3/8"	16937.7	95.9	**4**	0-5	
#4	17035.0	96.4	**4**		
#8					
#10					
#16					
#30					
#40					
#50					
#80					
#100					
#200					
PAN					

207

808

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	TRANSMITTAL NO.: OCF-008 DATE: 6-6-05
To: MIKE KEATING ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE, HWY 93 GOLDEN, CO	From: STEVEN MCQUEARY RFETS GOLDEN, CO
Specification Sec. No. 02223-0985	Project Title and Location: COVER ORIGINAL LANDFILL - ROCKY FLATS

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	GEOTEXTILE	3	1.03	N/A	

REMARKS

Data (MQC) is acceptable. QA testing of differing geotextiles is required to verify that spec is being met; Use 12" minimum overlaps, 18"–24" preferable. CQAE J.H. Fakett

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

S. McQueary [signature]

NAME AND SIGNATURE OF CONTRACTOR

- [x] APPROVED
- [ ] APPROVED AS CORRECTED
- [ ] NOT APPROVED
- [ ] REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

SITE QA MANAGER / DATE

J M Keating 6/06/05

RESPONSIBLE MANAGER DATE

G AUTHORITY	DATE

NILEX

Nilex Corporation
15171 East Fremont Drive
Centennial, CO 80112
Ph: (303) 766-2000
Fax: (303) 766-1110

nilex.com
Good Stuff for the Earth ™

June 2, 2005

Jeremy Jaramillo
Envirocon, Inc.
651 Corporate Circle, Suite 114
Golden, CO 80401

Re: Nilex NW80 and Skaps GT180

Dear Jeremy:

With this letter, I would like to inform you that Nilex is the authorized private-label distributor for Skaps Industries' geotextiles. The certification that I previously emailed you is for the Skaps GT180, privately labelled though Nilex as the NW80.

Yours truly,
Nilex Corporation

Saskia van Woudenberg
svw@nilex.com

SKAPS Industries (Nonwoven Division)
316 South Holland Drive
Pendergrass, GA 30567 (U.S.A.)
Phone (706) 693-3440 Fax (706) 693-3450
E-mail: info@skaps.com

Sales Office:
Engineered Synthetic Product Inc.
Phone: (770)564-1857
Fax: (770)564-1818

June 2, 2005
Nilex Corporation
15171 East Fremont Drive
Centennial, CO 80112-4202
PO : 2679
BOL : 14382

Dear Sir/Madam:

This is to certify that SKAPS GT180 is a high quality needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, randomly networked to form a high strength dimensionally stable fabric. SKAPS GT180 resists ultraviolet deterioration, rotting, biological degradation. The fabric is inert to commonly encountered soil chemicals. Polypropylene is stable within a pH range of 2 to 13. SKAPS GT180 conforms to the property values listed below:

PROPERTY	TEST METHOD	UNITS	M.A.R.V. Minimum Average Roll Value
Weight(Typical)	ASTM D 5261	oz/sy (g/m^2)	8.00 (271)
Grab Tensile	ASTM D 4632	lbs (kN)	205 (0.91)
Grab Elongation	ASTM D 4632	%	50
Trapezoidal Tear	ASTM D 4533	lbs (kN)	85 (0.38)
Puncture Resistance	ASTM D 4833	lbs (kN)	130 (0.58)
Permittivity*	ASTM D 4491	sec^{-1}	1.40
Water Flow	ASTM D 4491	gpm/ft^2(l/min/m^2)	90 (3667)
AOS	ASTM D 4751	US Sieve (mm)	80 (0.18)
UV Resistance	ASTM D 4355	%/hrs	70/500

Notes:
* At the time of manufacturing. Handling may change these properties.

ANURAG SHAH
QUALITY CONTROL MANAGER

Product : GT180-15

ROLL #	WEIGHT*	MD TENSILE	MD ELONG	XMD TENSILE	XMD ELONG	MD TRAP	XMD TRAP	PUNCTURE	AOS	WATER FLOW	PERMITT-IVITY
ASTM METHOD	D5261	D4632	D4632	D4632	D4632	D4533	D4533	D4833	D4751	D4491	D4491
UNITS	oz/sq yd	lbs.	%	lbs	%	lbs.	lbs	lbs.	US Sieve	gpm/ft^2	sec^{-1}
TARGET	8.00	205	50	205	50	85	85	130	80	90	1.40
1.78841	8.21	208	74	229	82	86	112	136	80	112	1.49
1.78843	8.21	208	74	229	82	86	112	136	80	112	1.49
2.41427	8.49	211	65	236	76	91	103	131	80	114	1.52
2.41433	8.13	206	71	231	84	88	109	139	80	114	1.52
2.41435	8.20	213	62	239	79	88	109	139	80	114	1.52
2.41436	8.20	213	62	239	79	88	109	139	80	114	1.52
2.41437	8.20	213	62	239	79	88	109	139	80	114	1.52
2.41440	8.04	207	70	226	81	94	105	133	80	114	1.52
2.41449	8.26	215	66	233	75	94	105	133	80	114	1.52
2.41478	8.11	209	73	228	83	85	111	140	80	114	1.52
2.41487	8.35	212	60	235	80	92	107	136	80	114	1.52
2.41491	8.22	205	67	230	89	87	113	138	80	114	1.52
2.45958	8.38	214	64	237	77	90	108	130	80	109	1.45
100.675	7.67	210	72	227	85	86	115	134	80	112	1.50
100.676	7.67	210	72	227	85	86	115	134	80	112	1.50
NG0984590	8.28	213	61	240	78	95	106	132	80	111	1.48
NG0984591	8.28	213	61	240	78	95	106	132	80	111	1.48
NG0986314	8.01	206	68	229	86	89	110	137	80	113	1.51
NG0986659	8.45	211	63	234	82	93	104	135	80	108	1.44
NG0986660	7.56	208	75	225	88	88	114	131	80	108	1.44
NG0986661	7.56	208	75	225	88	88	114	131	80	108	1.44
NG0986674	8.19	212	69	238	76	94	100	140	80	108	1.44
NG0987295	7.90	207	73	231	90	90	109	133	80	115	1.53
NG0987300	8.21	210	62	239	84	92	102	139	80	107	1.43
NG0987311	8.06	205	70	232	88	85	111	136	80	107	1.43
NG0987312	8.06	205	70	232	88	85	111	136	80	107	1.43
NG0987394	8.33	214	65	235	75	91	103	138	80	107	1.43

*Weight is typical. All other values are MARV.

NILEX

NILEX CORPORATION
15171 East Fremont Drive
Centennial, Colorado 80112
(303) 766-2000 phone
(303) 766-1110 fax
www.nilex.com

Nonwoven Geotextile Installation Instructions

Geotextile Unloading & Storage

A. The geotextile shall be labeled, stored and handled in accordance with ASTM D-4873 "Guide for Identification, Storage, and Handling of Geotextiles."

B. Geotextile rolls are to be unloaded in a manner to prevent damage to the geotextile material.

C. The geotextile rolls should be inspected to ensure the shipping wrapper is intact. Those rolls that are not protected with the shipping wrap should be covered to prevent weather or UV light exposure.

D. Materials damaged during shipping should be inspected prior to placement.

E. Rolls should be stored on supports that will not damage the material. The material must be elevated at least 2" above the subgrade.

Material Deployment

A. Material is to be deployed in accordance with the design engineer's specifications.

B. The installer should be prepared to use sand bags to hold the edges of geotextile in place.

C. The installer should exercise caution when installing material in high moisture.

D. The installer should exercise caution when installing in windy conditions.

~~E. Geotextile materials shall be installed utilizing techniques that will not damage the material~~ during installation.

F. All folds and wrinkles are to be removed prior to sewing adjacent panels.

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Material Seaming

A. Field seams are to be made by sewing together fabric using sewing machines that are manufactured for field use. Nilex recommends the following models: Union Special 2200, American Newlong or Equal.

B. The thread should be a polypropylene, polyester or nylon bonded and thermally set with a minimum 2000 denier. Nilex recommends the use of BT207 nylon sewing thread which meets or exceeds criteria.

C. Seams for nonwoven geotextile are normally prayer seams. When sewing a prayer seam, the stitching should be approximately 1.5 inches from the outside edge of the fabric.

D. The seams per inch should be per the manufacturer's recommendation for the type and thickness of the geotextile fabric.

Geotextile Documentation

A. Manufacturer to provide certification and material samples in accordance with the project specification to the Owner/design engineer for approval prior to shipment of material.

B. Manufacturer to provide manifest and production certifications via mail to the owner/engineer upon shipment of material.

Repairs

A. Installer will follow project specifications for repair techniques.

B. In the event of no specification, the installer will utilize a piece of fabric large enough to allow one foot overlap around the perimeter or on either side of the repair. The installer will sew the additional material over the repair area.

Heat Seaming of Nonwoven Geotextiles

On geotextiles seven (7) ounces per yard or heavier, using fusion seaming with a heat gun may be used. The minimum overlap for this type of welding is four (4) inches. Prior to fusion seaming the geotextile together, the installer must demonstrate to the field engineer the ability to perform this type of installation method. Areas burned through that are damaged by fusion welding shall be properly repaired. Care should be taken during installation to prevent damage to the geotextile. Torn or punctured material shall be patched with sufficient overlap to prevent separation.

Installation Guidelines for Overlapping Geotextiles

The site should be cleared, grubbed and excavated to design grade, stripping all topsoil, soft soils, or any unsuitable materials. Proof rolling should be considered to help locate unsuitable soft materials.

The subgrade to receive the geotextile should be free of any object that could damage the geotextile.

Once the subgrade along a particular segment if the road alignment has been prepared, the geotextile should be rolled in line with the placement of the new roadway aggregate. The geotextile shall be laid without wrinkles and folds in the roadway aggregate. The geotextile should not be dragged across the subgrade. The entire roll should be placed and rolled out as smoothly as possible.

Adjacent geotextile rows should be overlapped as required. Overlaps shall be in the direction shown on the plans.

Geotextile panels shall be continuously overlapped a minimum of 300mm (12"). Where it is required that seams be oriented across the slope, the upper panel shall be lapped over the lower panel. Overlapped sections can be secured with staples if necessary.

For curves, the geotextile should be folded or cut and overlapped in the direction of the turn (previous fabric on top). Folds in the geotextile should be stapled or pinned approximately 0.6m on centers.

Before covering, the condition of the geotextile should be checked for excessive damage (i.e. holes, rips, tears, etc.) Repair defects by placing an additional layer of geotextile over the damaged area. The minimum required overlap required for adjacent rolls should extend 12" beyond the defect in all areas. The patches shall be continuously fastened using a sewn seam or staples to secure the patch. Geotextile which cannot be repaired shall be replaced.

If any further information is needed, please feel free to contact me.

Respectfully,
NILEX CORPORATION

Saskia van Woudenberg
President

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TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	TRANSMITTAL NO.: OLF- 009 DATE: 6-21-05

To:	Mike Keating (K-H) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200		From:	Steven McQueary (Envirocon) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200

Specification Sec. No. 02200-0982

Project Title and Location: Cover Original Landfill - Rocky Flats

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	Lafarge Fines for Buttress Construction	3	1.04 A	N/A	N/A

REMARKS Although gradation is slightly out of spec. for buttress fill, the strength appears adequate for compacted fill. Earth Tech needs to approve this material for use in buttress fill in writing. CQAE [signature]

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary [signature]
NAME AND SIGNATURE OF CONTRACTOR

- ☑ APPROVED
- ☐ APPROVED AS CORRECTED
- ☐ NOT APPROVED
- ☐ REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

SITE QA MANAGER / DATE

J M Keating 6/21/05
RESPONSIBLE MANAGER DATE

AUTHORITY	DATE

ATTERBERG LIMITS

AS RECEIVED WATER CONTENT	
Tare No.	
Wt. Wet Soil & Tare (gm)	0.00
Wt. Dry Soil & Tare (gm)	0.00
Wt. of Tare (gm)	0.00
Wt. of Water (gm)	0.00
Weight of Dry Soil (gm)	0.00
Moisture Content (%)	#DIV/0!

PROJECT NAME	Kaiser Hill/Rocky Flats Field & Lab
PROJECT NUMBER:	053-2203-0001
SAMPLE ID:	LPF-3
TYPE	Pail

LAFARGE PIT FINES (BUTTRESS FILL)

4 OR 3 POINT ATTERBERG

	PLASTIC LIMIT DETERMINATION		IQUID LIMIT DETERMINATION		
Number of Blows			21	27	32
Weight of Wet Soil & T	23.81	21.18	24.58	23.66	24.82
Weight of Dry Soil & T	22.56	20.27	21.41	20.86	21.96
Weight of Tare (gm)	13.81	13.90	13.84	13.82	14.57
Weight of Water (gm)	1.25	0.91	3.17	2.80	2.86
Weight of Dry Soil (gm)	8.75	6.37	7.57	7.04	7.39
Water Content %	14.29	14.29	41.88	39.77	38.70

PLASTIC LIMIT (PL): 14

LIQUID LIMIT (LL): 40

PLASTICITY INDEX (PI): 26

BLOWS	MC		
21	41.88	3.04	25
27	39.77	3.30	0.00
32	38.70	3.47	-2
0	0.00	#NUM!	

3 POINTS

				3-POINTS
	25.00	25.00	10.00	
38.70	41.88	40.50	40.50	40
-2	42.00	40.50		14
				26

ONE POINT ATTERBERG

Number of Blows	PLASTIC LIMITS		LIQUID LIMITS	
Weight of Wet Soil & Tare (gm)				
Weight of Dry Soil & Tare (gm)				
Weight of Tare (gm)				
Weight of Water (gm)	0.00	0.00		
Weight of Dry Soil (gm)	0.00	0.00	0.00	0.00
Water Content %	#DIV/0!	#DIV/0!	0.00	0.00
			#DIV/0!	#DIV/0!

	TRIAL 1	TRIAL 2
BLOWS:	0	0
K VALUE:	#N/A	#N/A

PLASTIC LIMIT (PL):

LIQUID LIMIT (LL):

PLASTICITY INDEX (PI):

NON-PLASTIC

Number of Blows	PLASTIC LIMITS		LIQUID LIMITS	
Weight of Wet Soil & Tare (gm)				
Weight of Dry Soil & Tare (gm)				
Weight of Tare (gm)				
Weight of Water (gm)	0.00	0.00	0.00	0.00
Weight of Dry Soil (gm)	0.00	0.00	0.00	0.00
Water Content %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

NP

PLASTIC LIMIT (PL): NP

LIQUID LIMIT (LL): NP

PLASTICITY INDEX (PI): NP

Golder Associates Inc.

HYDROMETER DATA ENTRY SHEET

AS RECEIVED WATER CONTENT

Tare No.	
Wt. Wet Soil & Tare (gm)	
Wt. Dry Soil & Tare (gm)	
Wt. of Tare (gm)	
Wt. of Water (gm)	0.00
Weight of Dry Soil (gm)	0.00
Moisture Content (%)	--

MONTH AND YEAR	May-05
PROJECT NAME	Kaiser Hill/Rocky Flats Field & Lab
PROJECT NUMBER:	053-2203-0001
SAMPLE ID:	LPF-3 Depth (ft) -
TYPE	Pail

Description: Brownish yellow (10 YR 6/8) clayey sand

USCS: SC

HYGROSCOPIC MOISTURE FOR MINUS #4 SIEVE SAMPLE

Wt. Soil & Tare (gm)	136.20
Dry Soil & Tare (gm)	133.50
Tare Weight (gm)	24.94
Moisture Content (%)	2.5

LL	40	TEST BY	DT
PL	14	DATE SET UP	5/24/05
PI	26	REVIEW BY	MB

Total Weight of Sample Used For Sieve Analysis Corrected for Hygroscopic Moisture

Total Weight (gm) 26242.2

cobbles	0.00	
coarse gravel	0.00	
fine gravel	14.51	14.51
coarse sand	16.47	
medium sand	25.99	
fine sand	20.35	62.81
fines	22.67	
		100.00

HYDROMETER ANALYSIS

Specific Gravity (ass'd)	2.70
Specific Gravity (tested)	
Amount Dispersing Agent (ml)	125.00
Type Dispersion Device	Mechanical
Length of Dispersion Period	1 Minute

PLUS #4 MATERIAL SIEVE — Tare Weight 0.00

Sieve	(Wt. + Tare)	Cumulative Wt. Retained	% RETAINED	% PASSING
12.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
3.0"	0.0	0.0	0.0	100.0
1.5"	0.0	0.0	0.0	100.0
1.0"	0.0	0.0	0.0	100.0
0.75"	0.0	0.0	0.0	100.0
0.375"	631.2	631.2	2.4	97.6
#4	3177.5	3808.7	14.5	85.5
Total Passing #4	22991.4			

WEIGHT OF SAMPLE USED FOR HYDROMETER TEST

Wt. of Sample Wet or Dry (gm) 50.8

DATE	TIME	READING R	TEMP T	HYD. COR. Cc
5/26/05	11:21			
5/26/05	11:23	16.5	21.70	5.00
5/26/05	11:26	15.3	21.6	5.00
5/26/05	11:36	14.8	21.6	5.00
5/26/05	11:51	14.5	21.6	5.00
5/26/05	12:21	14.3	21.7	5.00
5/26/05	15:31	13.5	22.9	5.00
5/27/05	11:21	12.3	23.3	5.00

(mm)	%Finer
0.036	19.64
0.023	17.50
0.013	16.65
0.009	16.22
0.007	15.79
0.003	14.51
0.001	12.38

BACK SIEVE — Tare Weight 0.00

Sieve				% PASSING
#10	9.55	9.6	19.27	69.0
#20	17.87	17.9	36.05	54.7
#40	24.62	24.6	49.67	43.0
#60	29.28	29.3	59.07	35.0
#100	33.12	33.1	66.82	28.4
#200	36.42	36.4	73.48	22.7

!!!!!
2.7
6

WEIGHT OF SAMPLE USED FOR HYDROMETER TEST

Calculated Dry Wt. used in test (gm)	49.57
Hydrometer Bulb Number	624378
%Pass #4 Sieve for whole sample	85.4863

HYDROMETER CALCULATIONS

ET (min)	TEMP COR K	READING C	EFFECTIVE LENGTH	A
2.00	0.013283	11.50	14.5	0.99
5.00	0.013283	10.25	14.7	0.99
15.00	0.013283	9.75	14.8	0.99
30.00	0.013283	9.50	14.8	0.99
60.00	0.013283	9.25	14.8	0.99
250.00	0.013126	8.50	15	0.99
1440.00	0.012973	7.25	15.2	0.99

	X-AXIS	Y-AXIS
12.0"	304.800	100.0
6.0"	154.200	100.0
6.0"	154.200	100.0
6.0"	154.200	100.0
3.0"	75.000	100.0
1.5"	37.500	100.0
1.0"	25.000	100.0
0.75"	19.000	100.0
0.375"	9.500	97.6
#4	4.750	85.5
#10	2.000	69.0
#20	0.850	54.7
#40	0.425	43.0
#60	0.250	35.0
#100	0.150	28.4
#200	0.075	22.7
	0.0358	19.6
	0.0228	17.5
	0.0132	16.6
	0.0093	16.2
	0.0066	15.8
	0.0032	14.5
	0.0013	12.4

KVALUES

Check By NG

TEMP Gs

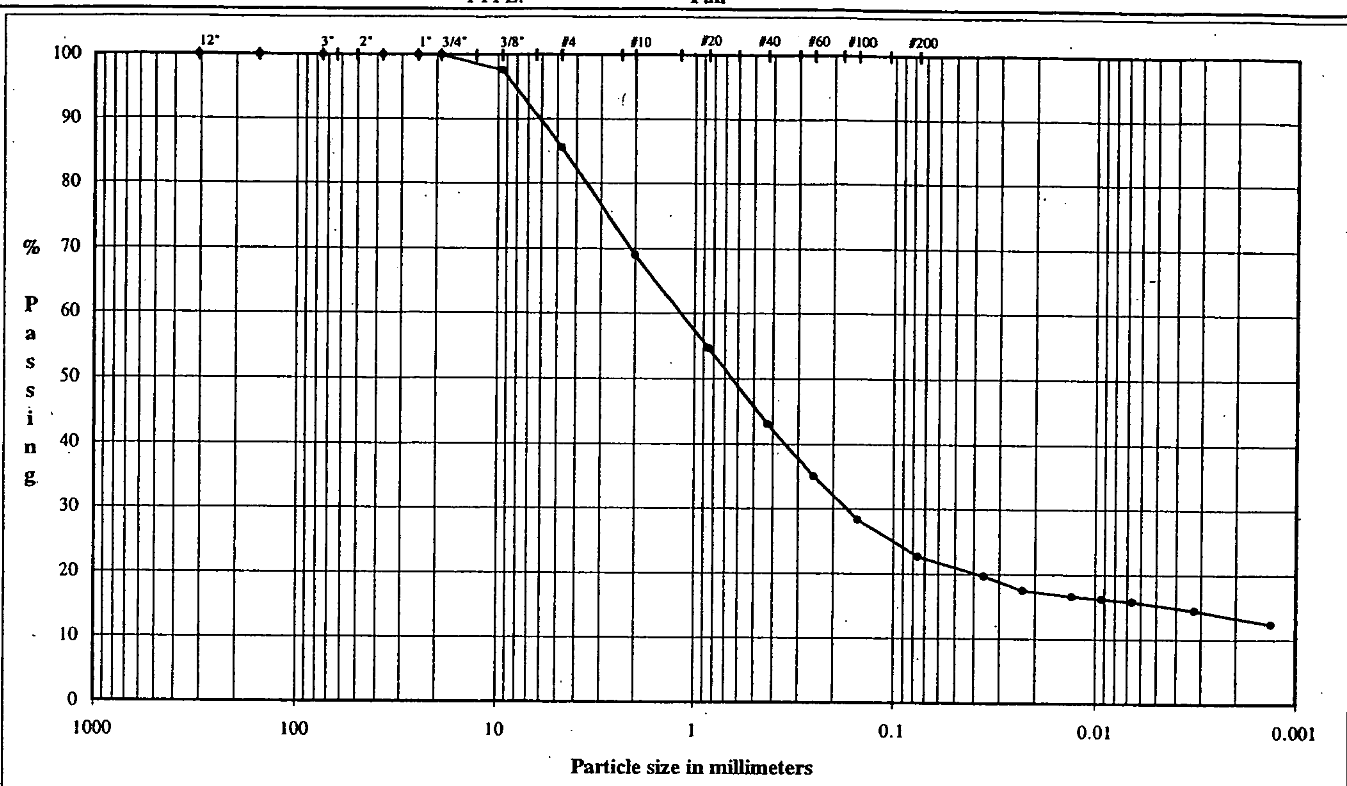
2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15

May-05 053-2203-0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: LPF-3 Depth (ft): -
TYPE: Pail



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

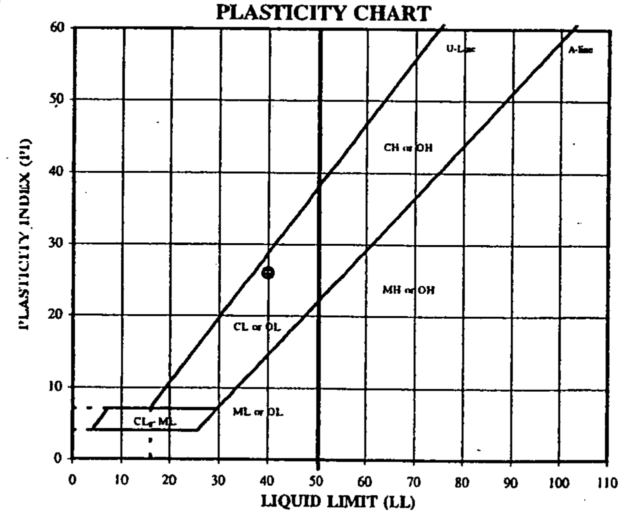
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Fine Gravel	14.51
0.375"	9.5	97.6		
#4	4.8	85.5		
#10	2.00	69.0	Coarse Sand	16.47
#20	0.85	54.7	Medium Sand	25.99
#40	0.43	43.0		
#60	0.25	35.0	Fine Sand	20.35
#100	0.15	28.4		
#200	0.075	22.7		

Hydrometer Analysis

(mm)	%Finer		
0.036	19.6	Fines Silt or Clay	22.67
0.023	17.5		
0.013	16.6		
0.0093	16.2		
0.0066	15.8		
0.0032	14.5		
0.0013	12.4		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	40	14	26	--

DESCRIPTION: Brownish yellow (10 YR 6/8) clayey sand

USCS: SC

TECH	DT
DATE	5/24/05
REVIEW	MB

Golder Associates Inc.

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MOISTURE DENSITY CURVES
ASTM D 698 & 1557

PROJECT TITLE	Kaiser Hill/Rocky Flats Field & Lab	TEST TYPE	D 698 D 4718
PROJECT NUMBER	053-2203-0001	PROCEDURE	METHOD A
SAMPLE IDENTITY	LPF-3 - -		
SAMPLE TYPE	Pail		

TYPE COMPACTOR: Mechanical

PREPARATION: Wet Method

TYPE PROCTOR: Standard

5.5 -lbf. RAMMER WITH 12 INCH DROP

MOLD NUMBER	217
MOLD WEIGHT (gm)	2126.7
MOLD DIAMETER (in)	4.000
MOLD HEIGHT (in)	4.575
MOLD VOLUME (cu.ft)	0.0333

METHOD A: 20% OR LESS RETAINED ON #4

METHOD B: > 20% RETAINED ON #4 AND 20% OR LESS RETAINED ON 3/8"

METHOD C: > 20% RETAINED ON 3/8" AND < 30% RETAINED ON 3/4"

WATER CONTENT		COARSE FRACTION	TOTAL SAMPLE
Wet Wt Tare & Soil	(W1)		
Dry Wt Tare & Soil	(W2)		
Wt Tare	(W3)		
Wt Moisture	(W4=W1-W2)	0.00	0.00
Wt Dry Soil	(W5=W2-W3)	0.00	0.00
Water Content (dec)	(wc=W4/W5)		
Water Content (%)	(W4/W5)*100		

TOTAL WEIGHT BEFORE PROCESSING AND PERCENT RETAINED	
TOTAL WEIGHT, WET (COARSE & FINE)	26800.10
TOTAL WEIGHT, DRY (COARSE & FINE)	26242.16
WEIGHT RETAINED ON # 4 SIEVE (WET)	3808.70
WEIGHT RETAINED ON 3/8" SIEVE (WET)	
WEIGHT RETAINED ON 3/4" SIEVE (WET)	
PERCENT RETAINED ON # 4 SIEVE (DRY)	14.51%
PERCENT RETAINED ON 3/8" SIEVE (DRY)	0.00%
PERCENT RETAINED ON 3/4" SIEVE (DRY)	0.00%

POINT RESULTS (FINE)		1	2	3	4	5	6	7
Wt. Soil & Mold	(W1)	3952.8	4043.2	4126.0	4145.6	4119.6		
Weight of Mold	(W2)	2126.70	2126.70	2126.70	2126.70	2126.70		
Wt. Of Wet Soil	(W3=W1-W2)	1826.10	1916.50	1999.30	2018.90	1992.90		
Wet Density, wd (pcf)	(W3/453.6*Vm)	121.00	126.99	132.48	133.78	132.06		
WATER CONTENTS								
Wt Tare & Soil	(W4)	428.07	458.11	428.83	461.61	433.07		
Wt Tare & Soil	(W5)	399.56	422.82	392.43	417.22	388.84		
Wt Tare	(W6)	100.69	102.02	103.82	104.72	100.95		
Wt Moisture	(W7=W4-W5)	28.51	35.29	36.40	44.39	44.23		
Wt Dry Soil	(W8=W5-W6)	298.87	320.80	288.61	312.50	287.89		
Water Content (%)	(W7/W8)*100	9.5%	11.0%	12.6%	14.2%	15.4%		
Dry Density (pcf)	(wd/(1+wc))	110.5	114.4	117.6	117.1	114.5		

MAXIMUM DRY DENSITY (pcf)	117.9
OPTIMUM MOISTURE CONTENT (%)	12.8
Corrected Maximum Dry Density (pcf)	122.9
Corrected Optimum Moisture (%)	11.1

DESCRIPTION: Brownish yellow (10 YR 6/8) clayey sand

USCS: SC

Specific Gravity And Absorption of Coarse Aggregate - ASTM C 127-88

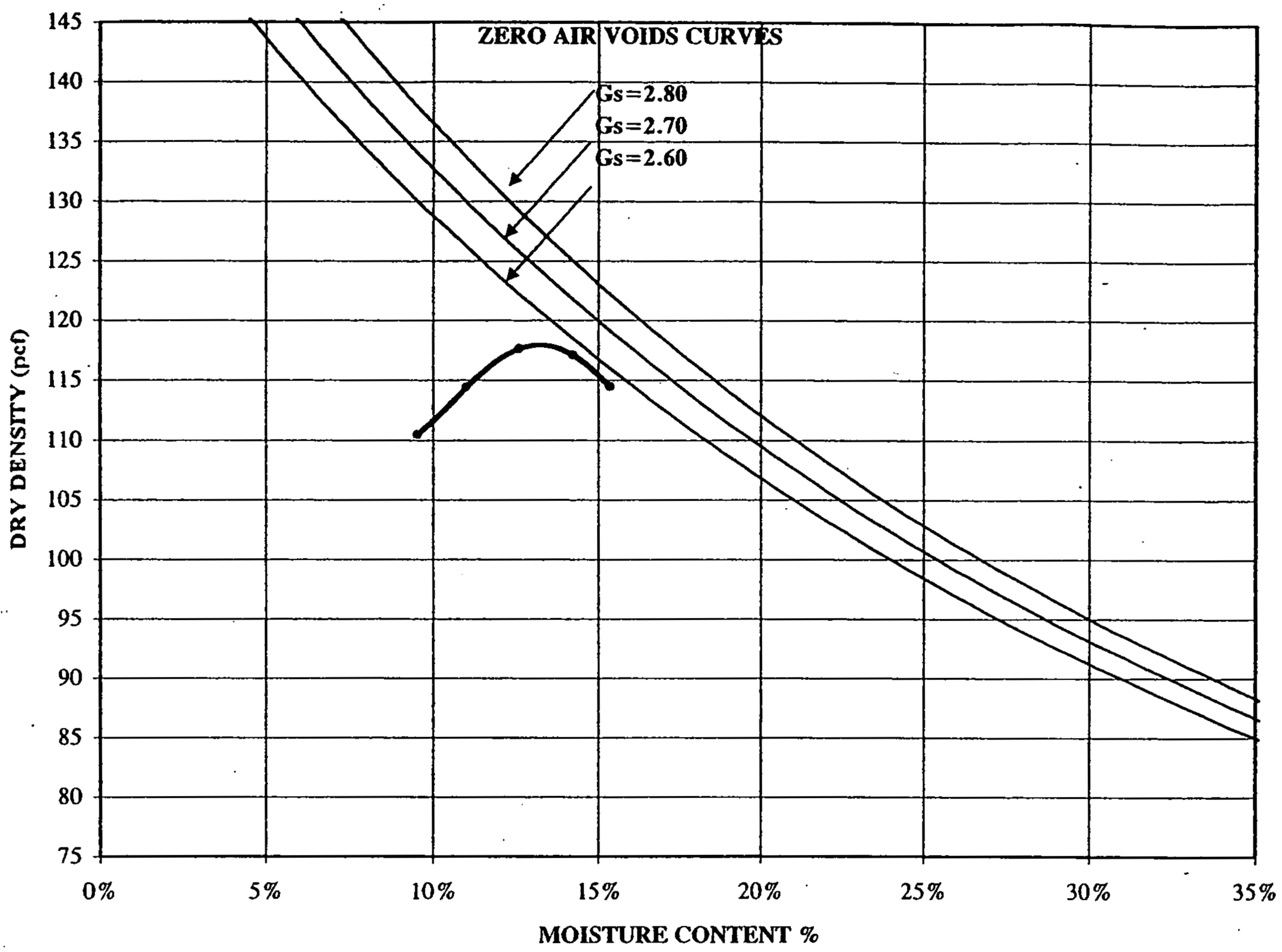
Weight of Oven Dry Sample (gm)	A	1175.70		
Weight of Saturated-Surface-Dry (gm)	B	1188.00		
Weight of Saturated Sample in Water (gm)	C	739.10		
Absorption of Oversize Particles (%)	[(B-A)/A]*100	1.05		
Bulk Specific Gravity	A/(B-C)	2.619		

LL	40
PL	14
PI	26
MC	–

AVERAGE ABSORPTION	1.0
AVERAGE BULK SPECIFIC GRAVITY	2.62

TECH	MKS
DATE	5-25-05
REVIEW	MB

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A



MAXIMUM DRY DENSITY (pcf)	117.9	Corrected Maximum Dry Density (pcf)	122.9
OPTIMUM MOISTURE (%)	12.8	Corrected Optimum Moisture (%)	11.1

SAMPLE ID	LPF-3
SAMPLE TYPE	Pail
SAMPLE DEPTH	-

LL	40
PL	14
PI	26
MC	--

DESCRIPTION Brownish yellow (10 YR 6/8) clayey sand

USCS SC

Kaiser Hill/Rocky Flats Field & Lab
053-2203-0001

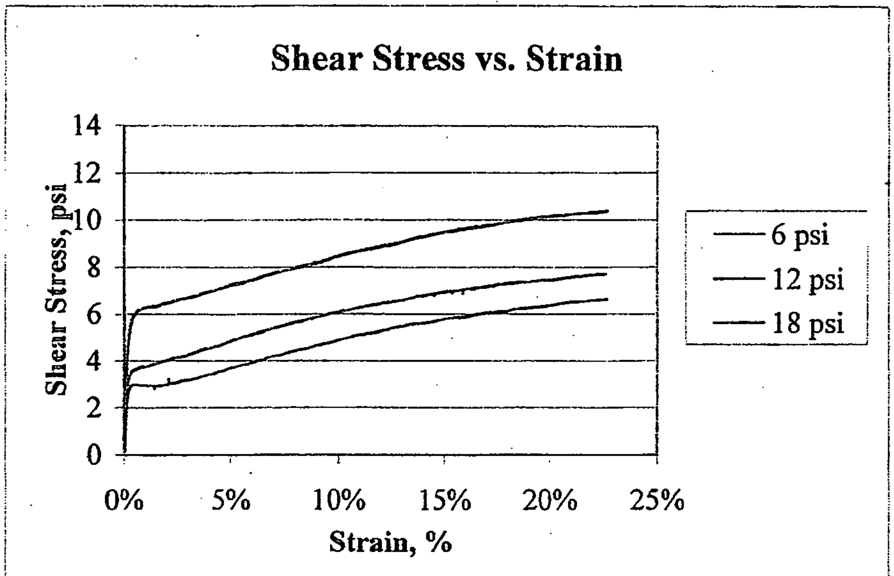
TECH	MKS
DATE	5-25-05
REVIEW	MB

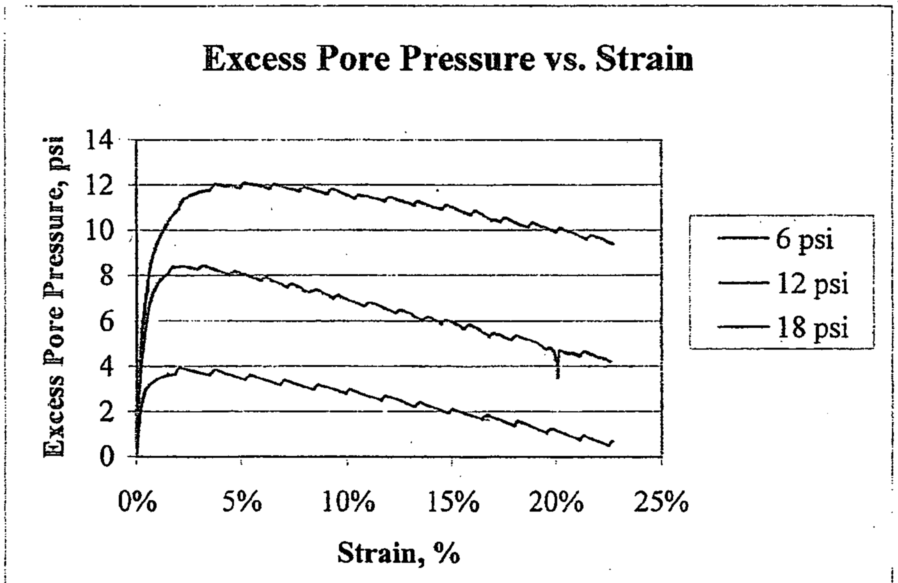
Sample # =	LPF 7		Sample # =	LPF 7		Sample # =	LPF 7	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	14.73	cm	Length =	14.80	cm	Length =	14.75	cm
Diameter =	7.30	cm	Diameter =	7.30	cm	Diameter =	7.30	cm
Wet Weight =	1272.10	g	Wet Weight =	1271.90	g	Wet Weight =	1272.40	g
Area =	41.9	sq.cm	Area =	41.9	sq.cm	Area =	41.9	sq.cm
Sample Area =	6.49	sq. in.	Sample Area =	6.49	sq. in.	Sample Area =	6.49	sq. in.
Volume =	616.5	cc	Volume =	619.4	cc	Volume =	617.3	cc
Moisture Content =	15.0%		Moisture Content =	15.0%		Moisture Content =	15.0%	
Specific Gravity =	na		Specific Gravity =	na		Specific Gravity =	na	
Dry Weight of Solids =	1106.17	g	Dry Weight of Solids =	1106.00	g	Dry Weight of Solids =	1106.43	g
Wet Density =	2.06	g/cc	Wet Density =	2.05	g/cc	Wet Density =	2.06	g/cc
Dry Density =	1.79	g/cc	Dry Density =	1.79	g/cc	Dry Density =	1.79	g/cc
Wet Density =	128.8	pcf	Wet Density =	128.1	pcf	Wet Density =	128.6	pcf
Dry Density =	112.0	pcf	Dry Density =	111.4	pcf	Dry Density =	111.8	pcf
Cell Pressure =	100	psi	Cell Pressure =	100	psi	Cell Pressure =	100	psi
Back Pressure =	94	psi	Back Pressure =	88	psi	Back Pressure =	82	psi
Confining Pressure =	6	psi	Confining Pressure =	12	psi	Confining Pressure =	18	psi

Notes:
1. Samples were remolded to approximately 95% of the maximum dry density and +2% relative to OMC based on ASTM D 698.
2. Specimen visually classified as strong brown (7.5yr 5/6) clayey sand with gravel.

Golder Associates, Inc. Denver, Colorado	Title:
Job Short Title: Kaiser Hill/Rocky Flats Field And Lab	TRIAXIAL SHEAR TEST REPORT SAMPLE DATA AND CALCULATIONS

Sample No.	Reviewed:	Date:	Job Number:	Figure:
LPF-7	JEO	6/20/2005	253-2203-0001	1





Golder Associates, Inc. Denver, Colorado	Title:
Job Short Title: Kaiser Hill/Rocky Flats Field And Lab	CU TRIAXIAL SHEAR DATA STRESS AND Δ PORE PRESSURE PLOTS

Sample No.	Reviewed:	Date:	Job Number:	Figure:
LPF-7	JEO	06/20/05	253-2203-0001	2

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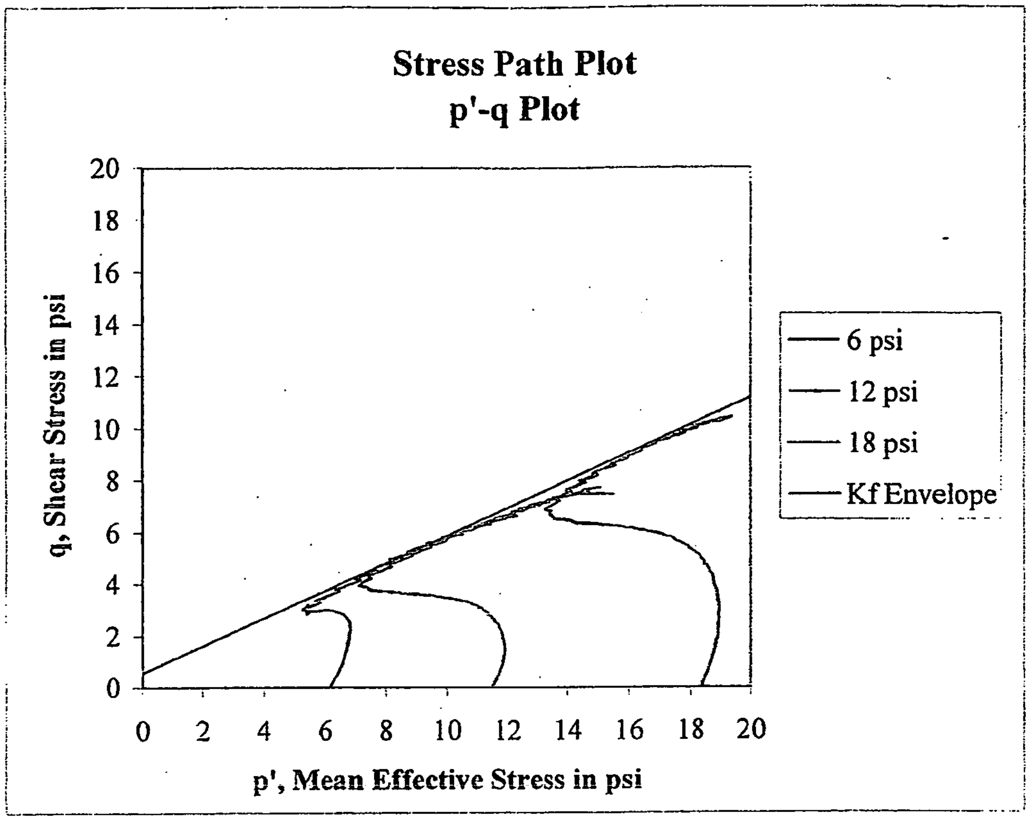
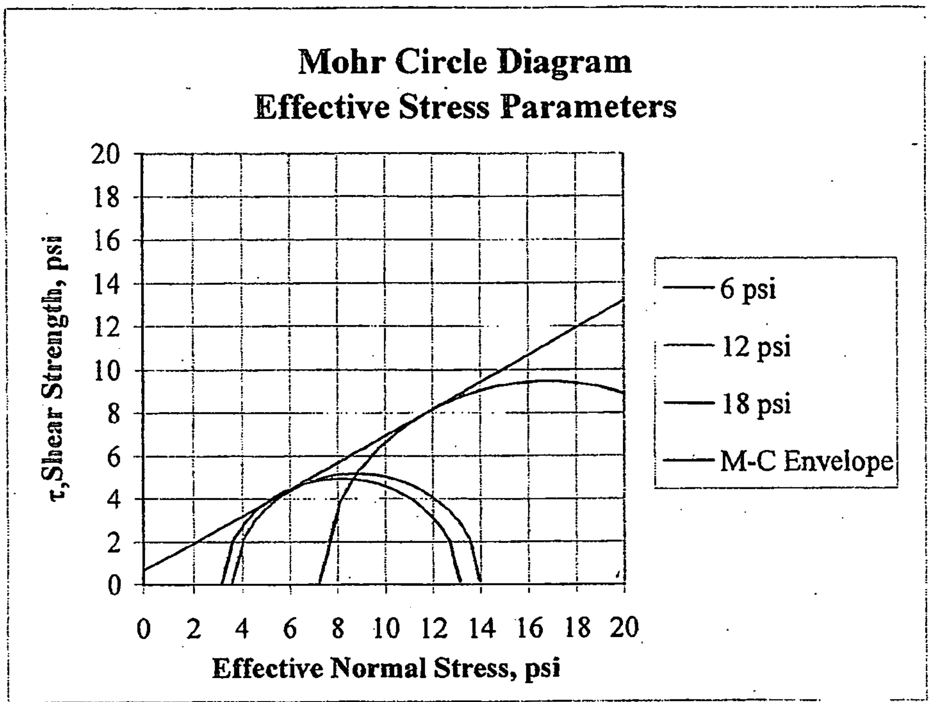


Stress Path Parameters

ψ' = 28.0 degrees
a' = 0.6 psi

Golder Associates, Inc. Denver, Colorado		Title: CU TRIAXIAL SHEAR DATA STRESS PATH PLOT		
Job Short Title: Kaiser Hill/Rocky Flats Field And Lab				
Sample No. LPF-7	Reviewed: JEO	Date: 6/20/2005	Job Number: 253-2203-0001	Figure: 3



Mohr-Coulomb Parameters

ϕ' =	32.1	degrees
c' =	0.7	psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **CU TRIAXIAL SHEAR DATA** **MOHR CIRCLE DIAGRAM**
Job Short Title: **Kaiser Hill/Rocky Flats Field And Lab**	

Sample No.	Reviewed:	Date:	Job Number:	Figure:
LPF-7	**JEO**	**6/20/2005**	**253-2203-0001**	4

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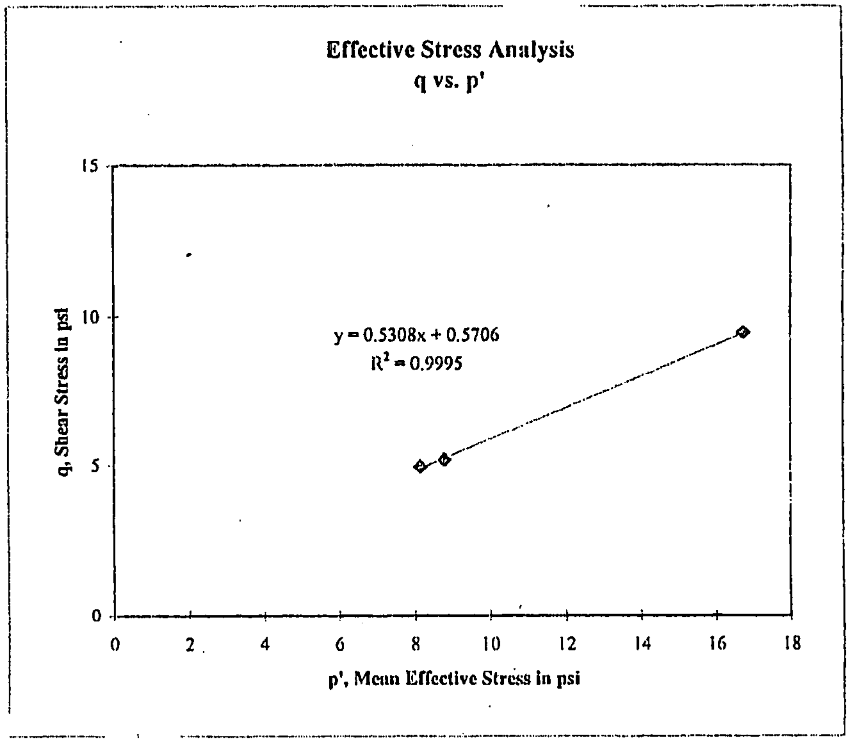
Consolidated Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: Kaiser Hill/Rocky Flats Field And Lab
Project Number: 253-2203-0001

Sample Number	LPF-7
Depth	
Effective Stress Analysis	

Point Number	p' (psi)	q (psi)
1	8.2	5.0
2	8.8	5.2
3	16.7	9.5

tan(ψ') = 0.5308
a' = 0.5705

ϕ' = 32.1 degrees
c' = 0.7 psi



219

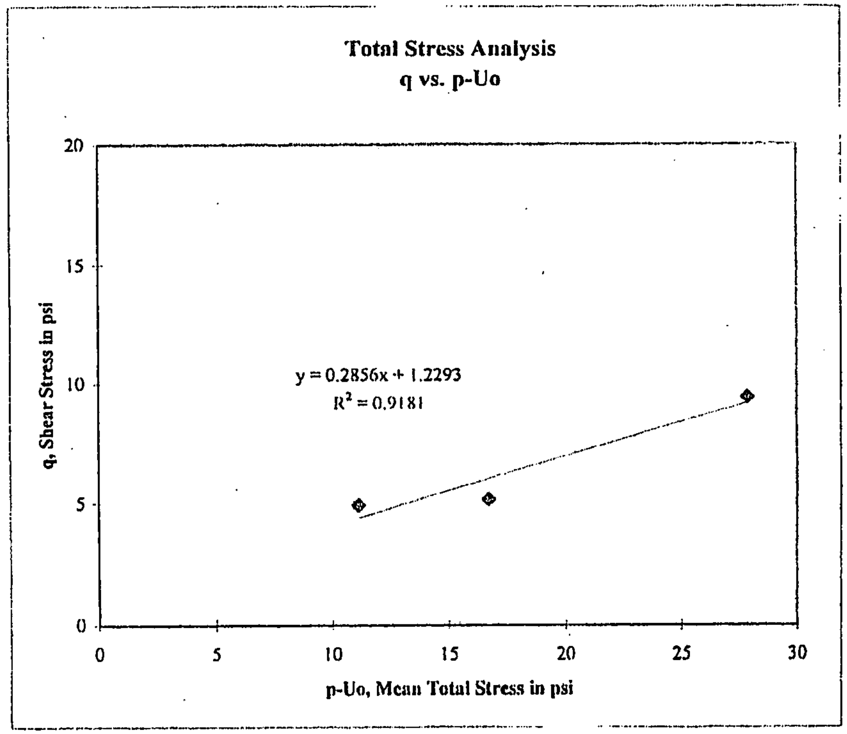
Consolidated Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: Kaiser Hill/Rocky Flats Field And Lab
Project Number: 253-2203-0001

Sample Number	LPF-7
Depth	
Total Stress Analysis	

Point Number	p-Uo (psi)	q (psi)
1	11.1	5.0
2	16.7	5.2
3	27.9	9.5

$\tan(\psi) =$ 0.2856
a = 1.2293

$\phi =$ 16.6 degrees
c = 1.3 psi



Consolidated Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: **Kaiser Hill/Rocky Flats Field And Lab**
Project Number: 253-2203-0001
Explanation of Terminology

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma_{ff}' \tan\phi'$$
$$\tau_{ff} = c + \sigma_{ff} \tan\phi$$

Where:
c', c = effective and total cohesive intercept
ϕ', ϕ = effective and total friction angle
τ_{ff} = Shear Strength on the failure surface at failure
σ'_{ff}, σ_{ff} = effective and total normal stress on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \quad p' = \frac{\sigma'_1 + \sigma'_3}{2} \quad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = shear stress
p', p = mean effective and total stress
σ'_1, σ_1 = Effective and Total Axial Stress
σ'_3, σ_3 = Effective and Total Confining Stress

$$q = a + p' \tan\psi$$
$$q = a + (p - u_0) \tan\psi$$

Where:
a', a = intercept of the q-axis in effective stress of total stress space
ψ', ψ = angle of the failure line in effective stress of total stress space
p' = mean effective stress
p-Uo = mean total minus the initial pore pressure

with the relationship between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$

$$a = c * \cos(\phi)$$

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	TRANSMITTAL NO.: OLF- 010 DATE: 7/18/05

To:	Mike Keating (K-H) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200	From: Steven McQueary (Envirocon) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200

Specification Sec. No. General Project

Project Title and Location: Cover Original Landfill - Rocky Flats

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	Geotechnical Testing Results for Pioneer Buttress Fill Material (Pit Fines)	3	02200-0982	N/A	N/A

REMARKS

Approval by Earth Tech Designers Req'd.

CQAE H. Raho TA
Appears Close to Des. Limits

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary
NAME AND SIGNATURE OF CONTRACTOR

- ☑ APPROVED
- ☐ APPROVED AS CORRECTED
- ☐ NOT APPROVED
- ☐ REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

AUTHORITY	DATE

SITE QA MANAGER / DATE

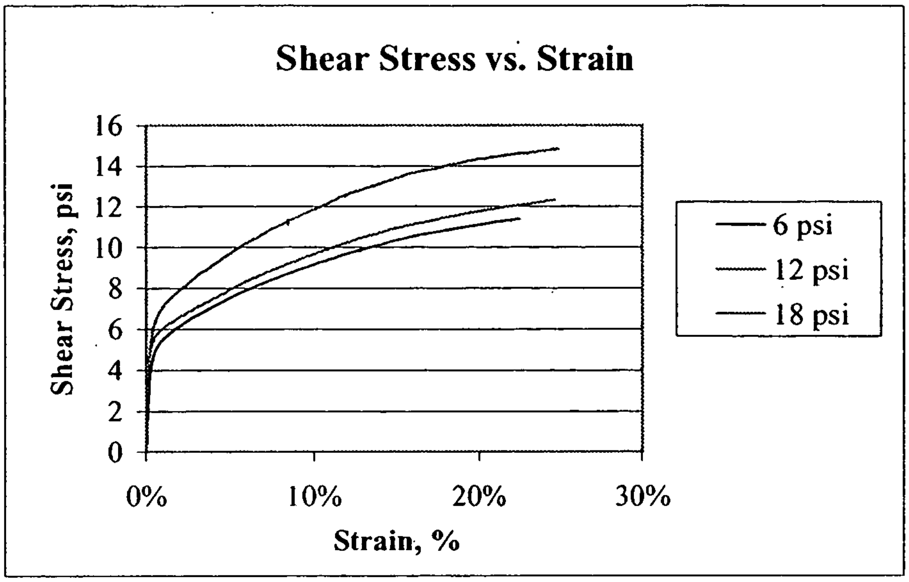
M Keating 7/18/05

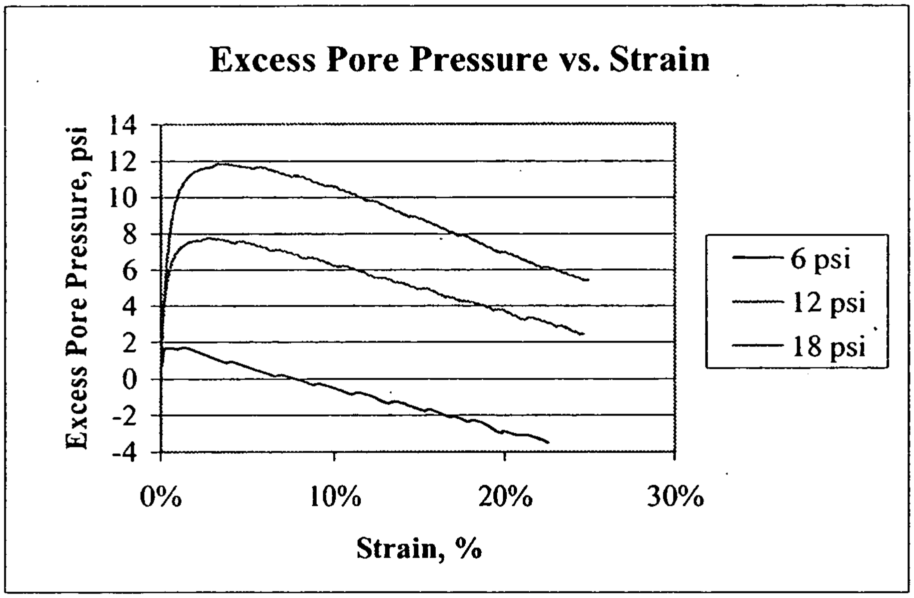
RESPONSIBLE MANAGER DATE

Sample # =	PSE 3		Sample # =	PSE 3		Sample # =	PSE 3	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	14.78	cm	Length =	14.82	cm	Length =	14.71	cm
Diameter =	7.30	cm	Diameter =	7.30	cm	Diameter =	7.30	cm
Wet Weight =	1283.90	g	Wet Weight =	1285.30	g	Wet Weight =	1285.30	g
Area =	41.9	sq.cm	Area =	41.9	sq.cm	Area =	41.9	sq.cm
Sample Area =	6.49	sq. in.	Sample Area =	6.49	sq. in.	Sample Area =	6.49	sq. in.
Volume =	618.6	cc	Volume =	620.3	cc	Volume =	615.7	cc
Moisture Content =	14.8%		Moisture Content =	14.8%		Moisture Content =	14.8%	
Specific Gravity =	na		Specific Gravity =	na		Specific Gravity =	na	
Dry Weight of Solids =	1118.38	g	Dry Weight of Solids =	1119.60	g	Dry Weight of Solids =	1119.60	g
Wet Density =	2.08	g/cc	Wet Density =	2.07	g/cc	Wet Density =	2.09	g/cc
Dry Density =	1.81	g/cc	Dry Density =	1.81	g/cc	Dry Density =	1.82	g/cc
Wet Density =	129.5	pcf	Wet Density =	129.3	pcf	Wet Density =	130.3	pcf
Dry Density =	112.8	pcf	Dry Density =	112.6	pcf	Dry Density =	113.5	pcf
Cell Pressure =	100	psi	Cell Pressure =	100	psi	Cell Pressure =	100	psi
Back Pressure =	94	psi	Back Pressure =	88	psi	Back Pressure =	82	psi
Confining Pressure =	6	psi	Confining Pressure =	12	psi	Confining Pressure =	18	psi

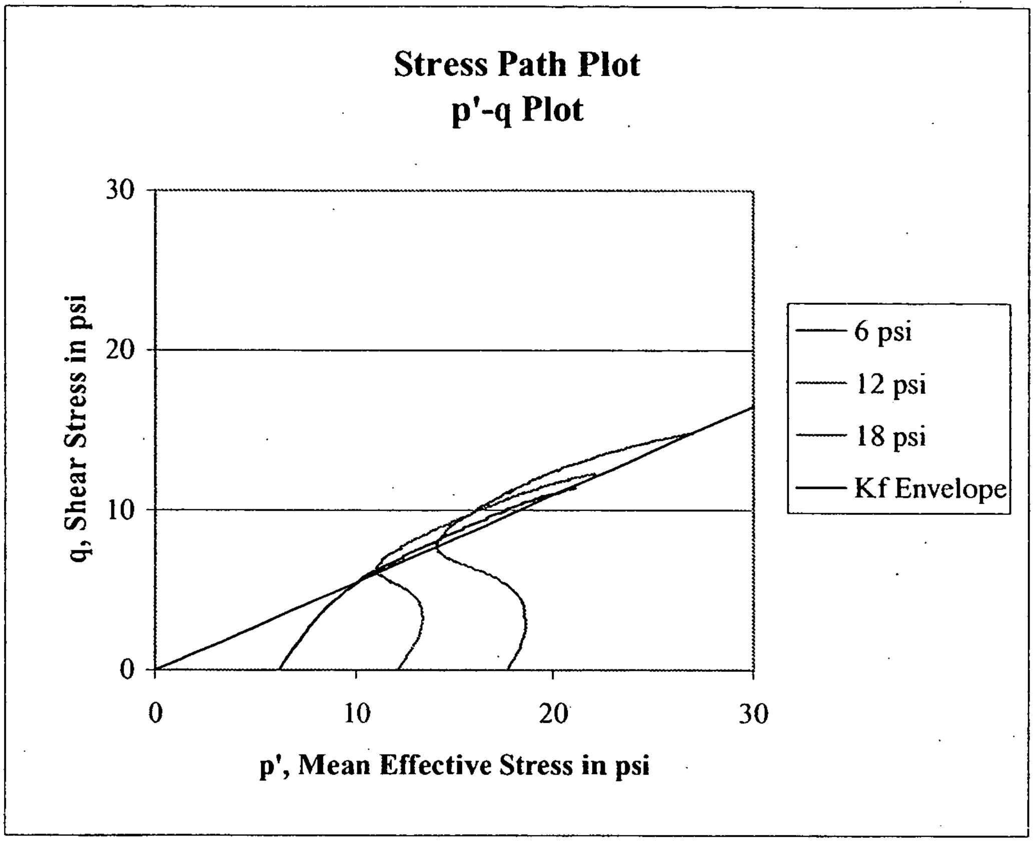
Notes:
1. Sample was remolded to approximately 95% of the maximum dry density and +2% relative to OMC (based on standard Proctor).
2. Sample consisted of brown clayey sand.
3. Failure was defined as the maximum deviator stress.

Golder Associates, Inc. **Denver, Colorado**	**Title:** TRIAXIAL SHEAR TEST REPORT SAMPLE DATA AND CALCULATIONS			
Job Short Title: Kaiser Hill/Rocky Flats Field and Lab				
Sample No. **PSE 3**	Reviewed: JEO	**Date:** 07/06/05	**Job Number:** 053-2203-0001	**Figure:** 1





Golder Associates, Inc. Denver, Colorado		**Title:** CU TRIAXIAL SHEAR DATA STRESS AND Δ PORE PRESSURE PLOTS		
Job Short Title: Kaiser Hill/Rocky Flats Field and Lab				
Sample No. PSE 3	Reviewed: JEO	Date: 07/06/05	Job Number: 053-2203-0001	Figure: 2



Stress Path Parameters

ψ' =	28.8	degrees
a' =	0.0	psi

Golder Associates, Inc. **Denver, Colorado**		Title:		
Job Short Title: **Kaiser Hill/Rocky Flats Field and Lab**		**CU TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**		
Sample No. **PSE 3**	Reviewed: **JEO**	Date: **07/06/05**	Job Number: **053-2203-0001**	Figure: 3

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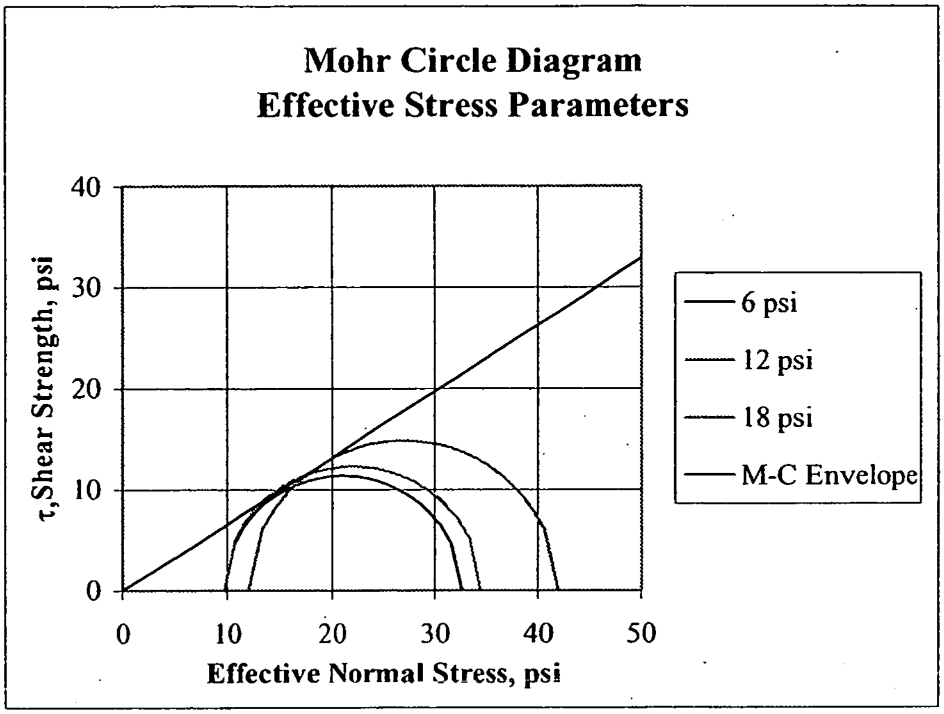

Mohr-Coulomb Parameters

ϕ ' =	33.4	degrees
c' =	0.0	psi

Golder Associates, Inc. **Denver, Colorado**	**Title:** **CU TRIAXIAL SHEAR DATA** **MOHR CIRCLE DIAGRAM**
Job Short Title: **Kaiser Hill/Rocky Flats Field and Lab**	

Sample No.	Reviewed:	Date:	Job Number:	Figure:
PSE 3	JEO	07/06/05	053-2203-0001	4

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Consolidated Undrained Triaxial Lab Data

From: GOLDER ASSOCIATES INC.

Project: Kaiser Hill/Rocky Flats Field and Lab

Project Number: 053-2203-0001

Sample Number	PSE 3
Depth	
Effective Stress Analysis	

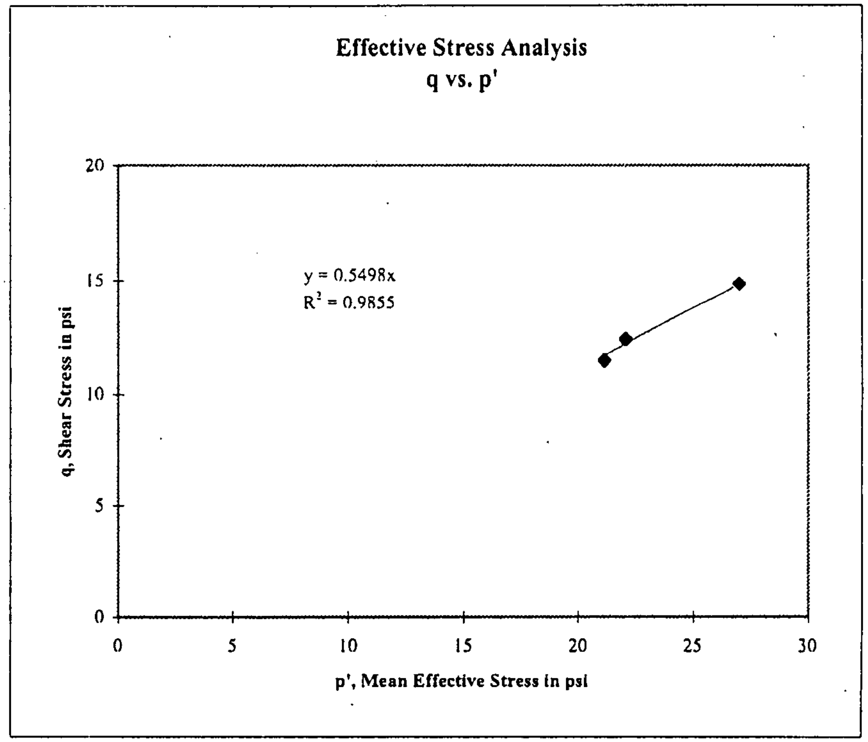
Point Number	p' (psi)	q (psi)
1	21.1	11.4
2	22.0	12.3
3	27.0	14.9

$\tan(\psi')$ = 0.5498

a' = 0

ϕ' = 33.4 degrees

c' = 0.0 psi



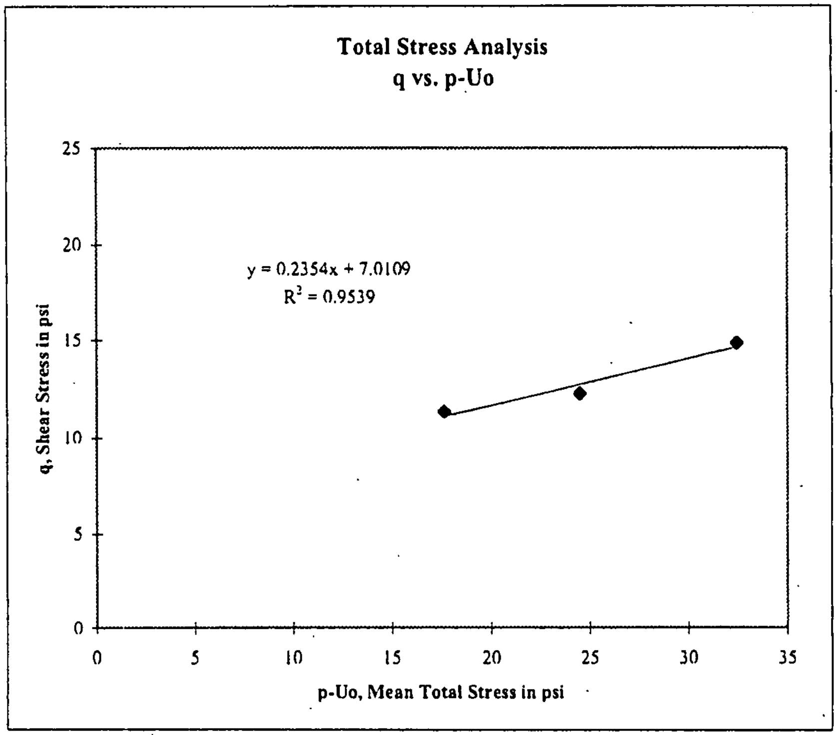
Consolidated Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: Kaiser Hill/Rocky Flats Field and Lab
Project Number: 053-2203-0001

Sample Number	PSE 3
Depth	
Total Stress Analysis	

Point Number	p-Uo (psi)	q (psi)
1	17.6	11.4
2	24.5	12.3
3	32.4	14.9

$\tan(\psi) =$ 0.2354
a = 7.0109

$\phi =$ 13.6 degrees
c = 7.2 psi



Consolidated Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: Kaiser Hill/Rocky Flats Field and Lab
Project Number: 053-2203-0001
Explanation of Terminology

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma_{ff}' \tan\phi'$$
$$\tau_{ff} = c + \sigma_{ff} \tan\phi$$

Where:
c', c = effective and total cohesive intercept
ϕ', ϕ = effective and total friction angle
τ^{ff} = Shear Strength on the failure surface at failure
σ'^{ff}, σ^{ff} = effective and total normal stress on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \qquad p' = \frac{\sigma'_1 + \sigma'_3}{2} \qquad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = shear stress
p', p = mean effective and total stress
σ'_1, σ_1 = Effective and Total Axial Stress
σ'_3, σ_3 = Effective and Total Confining Stress

$$q = a + p' \tan\psi$$
$$q = a + (p - u_0) \tan\psi$$

Where:
a', a = intercept of the q-axis in effective stress of total stress space
ψ', ψ = angle of the failure line in effective stress of total stress space
p' = mean effective stress
p-Uo = mean total minus the initial pore pressure

with the relationship between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$

$$a = c * \cos(\phi)$$

2241

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TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE

TRANSMITTAL NO.: OLF- 011
DATE: 7/18/05

To:	Mike Keating (K-H) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200	**From:**	Steven McQueary (Envirocon) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200

Specification Sec. No. General Project
Project Title and Location: Cover Original Landfill - Rocky Flats

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	Geotextile	3	02223-0985	N/A	N/A

REMARKS
Additional Rolls of Geotextile used after initial submittal

OK CQAE J.H. Ralott

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary
NAME AND SIGNATURE OF CONTRACTOR

- [x] APPROVED
- [ ] APPROVED AS CORRECTED
- [ ] NOT APPROVED
- [ ] REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

SITE QA MANAGER / DATE

MKeating
RESPONSIBLE MANAGER

DATE 7/18/05

AUTHORITY	DATE

SKAPS Industries (Nonwoven Division)
316 South Holland Drive
Pendergrass, GA 30567 (U.S.A.)
Phone (706) 693-3440 Fax (706) 693-3450
E-mail: info@skaps.com

Sales Office:
Engineered Synthetic Product Inc.
Phone: (770)564-1857
Fax: (770)564-1818

June 2, 2005
Nilex Corporation
15171 East Fremont Drive
Centennial, CO 80112-4202
PO : 2679
BOL : 14382

Dear Sir/Madam:

This is to certify that SKAPS GT180 is a high quality needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, randomly networked to form a high strength dimensionally stable fabric. SKAPS GT180 resists ultraviolet deterioration, rotting, biological degradation. The fabric is inert to commonly encountered soil chemicals. Polypropylene is stable within a pH range of 2 to 13. SKAPS GT180 conforms to the property values listed below:

PROPERTY	TEST METHOD	UNITS	M.A.R.V. Minimum Average Roll Value
Weight(Typical)	ASTM D 5261	oz/sy (g/m^2)	8.00 (271)
Grab Tensile	ASTM D 4632	lbs (kN)	205 (0.91)
Grab Elongation	ASTM D 4632	%	50
Trapezoidal Tear	ASTM D 4533	lbs (kN)	85 (0.38)
Puncture Resistance	ASTM D 4833	lbs (kN)	130 (0.58)
Permittivity*	ASTM D 4491	sec^{-1}	1.40
Water Flow	ASTM D 4491	gpm/ft^2(l/min/m^2)	90 (3667)
AOS	ASTM D 4751	US Sieve (mm)	80 (0.18)
UV Resistance	ASTM D 4355	%/hrs	70/500

Notes:
* At the time of manufacturing. Handling may change these properties.

ANURAG SHAH
QUALITY CONTROL MANAGER

226

Product : GT180-15

ROLL #	WEIGHT*	MD TENSILE	MD ELONG	XMD TENSILE	XMD ELONG	MD TRAP	XMD TRAP	PUNCTURE	AOS	WATER FLOW	PERMITT-IVITY
ASTM METHOD	D5261	D4632	D4632	D4632	D4632	D4533	D4533	D4833	D4751	D4491	D4491
UNITS	oz/sq yd	lbs.	%	lbs	%	lbs.	lbs	lbs.	US Sieve	gpm/ft^2	sec^{-1}
TARGET	8.00	205	50	205	50	85	85	130	80	90	1.40
1.78841	8.21	208	74	229	82	86	112	136	80	112	1.49
1.78843	8.21	208	74	229	82	86	112	136	80	112	1.49
2.41427	8.49	211	65	236	76	91	103	131	80	114	1.52
2.41433	8.13	206	71	231	84	88	109	139	80	114	1.52
2.41435	8.20	213	62	239	79	88	109	139	80	114	1.52
2.41436	8.20	213	62	239	79	88	109	139	80	114	1.52
2.41437	8.20	213	62	239	79	88	109	139	80	114	1.52
2.41440	8.04	207	70	226	81	94	105	133	80	114	1.52
2.41449	8.26	215	66	233	75	94	105	133	80	114	1.52
2.41478	8.11	209	73	228	83	85	111	140	80	114	1.52
2.41487	8.35	212	60	235	80	92	107	136	80	114	1.52
2.41491	8.22	205	67	230	89	87	113	138	80	114	1.52
2.45958	8.38	214	64	237	77	90	108	130	80	109	1.45
100.675	7.67	210	72	227	85	86	115	134	80	112	1.50
100.676	7.67	210	72	227	85	86	115	134	80	112	1.50
NG0984590	8.28	213	61	240	78	95	106	132	80	111	1.48
NG0984591	8.28	213	61	240	78	95	106	132	80	111	1.48
NG0986314	8.01	206	68	229	86	89	110	137	80	113	1.51
NG0986659	8.45	211	63	234	82	93	104	135	80	108	1.44
NG0986660	7.56	208	75	225	88	88	114	131	80	108	1.44
NG0986661	7.56	208	75	225	88	88	114	131	80	108	1.44
NG0986674	8.19	212	69	238	76	94	100	140	80	108	1.44
NG0987295	7.90	207	73	231	90	90	109	133	80	115	1.53
NG0987300	8.21	210	62	239	84	92	102	139	80	107	1.43
NG0987311	8.06	205	70	232	88	85	111	136	80	107	1.43
NG0987312	8.06	205	70	232	88	85	111	136	80	107	1.43
NG0987394	8.33	214	65	235	75	91	103	138	80	107	1.43

*Weight is typical. All other values are MARV.

SKAPS Industries (Nonwoven Division)
316 South Holland Drive
Pendergrass, GA 30567 (U.S.A.)
Phone (706) 693-3440 Fax (706) 693-3450
E-mail: info@skaps.com

Sales Office:
Engineered Synthetic Product Inc.
Phone: (770)564-1857
Fax: (770)564-1818

July 5, 2005
Nilex Corporation
15171 East Fremont Drive
Centennial, CO 80112-4202
PO : 2793
BOL : 14654

Dear Sir/Madam:

This is to certify that SKAPS GT180 is a high quality needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, randomly networked to form a high strength dimensionally stable fabric. SKAPS GT180 resists ultraviolet deterioration, rotting, biological degradation. The fabric is inert to commonly encountered soil chemicals. Polypropylene is stable within a pH range of 2 to 13. SKAPS GT180 conforms to the property values listed below:

PROPERTY	TEST METHOD	UNITS	M.A.R.V. Minimum Average Roll Value
Weight (Typical)	ASTM D 5261	oz/sy (g/m^2)	8.00 (271)
Grab Tensile	ASTM D 4632	lbs (kN)	205 (0.91)
Grab Elongation	ASTM D 4632	%	50
Trapezoidal Tear	ASTM D 4533	lbs (kN)	85 (0.38)
Puncture Resistance	ASTM D 4833	lbs (kN)	130 (0.58)
Permittivity*	ASTM D 4491	sec^{-1}	1.40
Water Flow	ASTM D 4491	gpm/ft^2($l/min/m^2$)	90 (3667)
AOS	ASTM D 4751	US Sieve (mm)	80 (0.18)
UV Resistance	ASTM D 4355	%/hrs	70/500

Notes:
* At the time of manufacturing. Handling may change these properties.

ANURAG SHAH
QUALITY CONTROL MANAGER

Product : GT180-15

ROLL #	WEIGHT	MD TENSILE	MD ELONG	XMD TENSILE	XMD ELONG	MD TRAP	XMD TRAP	PUNCTURE	AOS	WATER FLOW	PERMITT-IVITY
ASTM METHOD	D5261	D4632	D4632	D4632	D4632	D4533	D4533	D4833	D4751	D4491	D4491
UNITS	oz/sq yd	lbs.	%	lbs	%	lbs.	lbs	lbs.	US Sieve	gpm/ft^2	sec^{-1}
TARGET	8.00	205	50	205	50	85	85	130	80	90	1.40
2.50025	8.12	213	75	239	79	94	112	137	80	113	1.51
2.50033	8.47	207	63	225	75	91	100	131	80	113	1.51
2.50035	8.16	211	69	231	90	91	100	131	80	113	1.51
2.50036	8.16	211	69	231	90	91	100	131	80	113	1.51
2.50037	8.16	211	69	231	90	91	100	131	80	113	1.51
2.50038	8.16	211	69	231	90	91	100	131	80	113	1.51
2.50039	8.16	211	69	231	90	91	100	131	80	113	1.51
2.50041	8.19	208	61	240	82	95	105	135	80	113	1.51
2.50042	8.19	208	61	240	82	95	105	135	80	113	1.51
2.50043	8.19	208	61	240	82	95	105	135	80	113	1.51
2.50044	8.19	208	61	240	82	95	105	135	80	113	1.51
2.50045	7.95	212	64	233	86	95	105	135	80	113	1.51
2.50046	7.95	212	64	233	86	95	105	135	80	113	1.51
2.50052	8.45	210	62	239	81	86	102	130	80	113	1.51
2.50053	8.45	210	62	239	81	86	102	130	80	113	1.51
2.50055	8.14	215	68	235	85	86	102	130	80	113	1.51
2.50056	8.14	215	68	235	85	86	102	130	80	113	1.51
2.50057	8.14	215	68	235	85	86	102	130	80	113	1.51
2.50058	8.14	215	68	235	85	86	102	130	80	113	1.51
2.50059	8.14	215	68	235	85	86	102	130	80	113	1.51
2.50060	8.29	205	65	231	83	89	111	139	80	113	1.51
2.50061	8.29	205	65	231	83	89	111	139	80	113	1.51
2.50073	8.10	208	75	228	89	91	107	133	80	113	1.51
2.50074	8.10	208	75	228	89	91	107	133	80	113	1.51
2.50075	8.48	213	70	232	76	91	107	133	80	113	1.51

*Weight is typical. All other values are MARV.

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TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE

TRANSMITTAL NO.: OLF-012
DATE: 7/19/05

To: Mike Keating (K-H)
Rocky Flats Environmental Technology Site
10808 Hwy. 93, Unit B
Golden, CO 80403-8200

From: Steven McQueary (Envirocon)
Rocky Flats Environmental Technology Site
10808 Hwy. 93, Unit B
Golden, CO 80403-8200

Specification Sec. No. General Project

Project Title and Location: Cover Original Landfill - Rocky Flats

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	NAG P550 Erosion Mat Certificate of Compliance, Material Specifications and Performance Specification	3	02227-0986	N/A	N/A
2	NAG C350 Erosion Mat Certificate of Compliance, Material Specifications and Performance Specification	3	02227-0986		

REMARKS

OK CQAE
J.H. Rale JX

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary
NAME AND SIGNATURE OF CONTRACTOR

- [x] APPROVED
- [ ] APPROVED AS CORRECTED
- [ ] NOT APPROVED
- [ ] REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

SITE QA MANAGER / DATE

J M Keating 7/19/05

RESPONSIBLE MANAGER DATE

AUTHORITY	DATE

NORTH AMERICAN GREEN
EROSION CONTROL Products Guaranteed SOLUTIONS

Date: July 19, 2005
Project: Rocky Flats, Colorado
Contractor: Kaiser-Hill
Contact: Jeremy Jaramillo, EnviroCon
Material Type & Quantity: 3,640 yds² (91 rolls) C350 Permanent Composite Turf Reinforcement Mat

CERTIFICATE OF COMPLIANCE
NORTH AMERICAN GREEN C350 EROSION CONTROL / COMPOSITE TURF REINFORCEMENT MATTING (C-TRM)

North American Green, Inc. certifies that the C350 Erosion Control/Composite Turf Reinforcement Mat has the properties and characteristics detailed below:

The C350 erosion control/composite turf reinforcement mat, manufactured by North American Green, is constructed with 100% coconut fiber at a rate of 0.50 lb/yd² (0.27 kg/m²) ± 10%. The fiber matrix is stitch bonded between a heavy duty, UV stabilized bottom net weighing approximately 8.0 lbs/1000 ft² (3.91 kg/100 m²) and a heavy duty, UV stabilized, corrugated, intermediate netting weighing approximately 24 lbs/1000 ft² (11.7 kg/100 m²) overlain with a heavy duty, UV stabilized top net weighing approximately 8.0 lbs/1000 ft² (3.91 kg/100 m²). The corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nets and coconut fiber matrix are sewn together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional structure. North American Green ships the C350 light blue color-coded packaging.

The blanket is manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) to ensure proper material overlapping.

The North American Green C350 erosion control/composite turf reinforcement mat should be applied only after proper soil preparation, fertilization and seeding. The C350 is designed to control soil loss, facilitate revegetation, and reinforce vegetation on disturbed sites. The C350 is ideal for steep slopes, channels and shoreline applications.

Installation staple patterns shall be clearly marked on the turf reinforcement matting with environmentally safe paint. All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

C350 is Available with the Following Physical Specifications per Roll [English Units (Metric Units)]

Width	6.50 ft (2.0 m)
Length	55.50 ft (16.92 m)
Weight ± 10%	37 lbs (16.78 kg)
Area	40 yd² (33.45 m²)

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)

To the best of our knowledge, the information above is accurate.

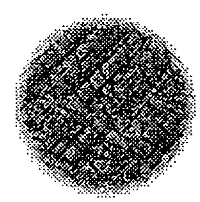
North American Green Representative
Roy J. Nelsen, CPESC

14649 Highway 41 North • Evansville, Indiana 47725 • 812-867-6632
800-772-2040 • FAX 812-8670247 • www.nagreen.com

NORTH AMERICAN GREEN®

MATERIAL SPECIFICATION

C350



The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% coconut fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between a super heavy duty UV stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, an ultra-heavy duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, and covered by a super heavy duty UV stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

The C350 shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the U.S. Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications For Construction of Roads and Bridges on Federal Highway Projects, FP-03 2003 Section 713.18* as a *Type 5A, B, and C Permanent Turf Reinforcement Mat.*

Installation staple patterns shall be clearly marked on the turf reinforcement matting with environmentally safe paint. All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The composite turf reinforcement mat shall be the North American Green C350, or equivalent. The C350 permanent composite turf reinforcement mat shall have the following physical properties:

Material Content

Matrix	100% Coconut Fiber (0.50 lb/yd²) (0.27 kg/m²)
Nettings	Top – Super Heavy Duty UV Stabilized Polypropylene 8.00 lbs/1,000 ft² (3.91 kg/100 m²)
	Mid – Corrugated Ultra-Heavy Duty UV Stabilized Polypropylene 24 lb/1,000 ft² (11.7 kg/100 m²)
	Bottom – Super Heavy Duty UV Stabilized Polypropylene 8.00 lbs/1,000 ft² (3.91 kg/100 m²)
Thread	UV Stabilized Polypropylene

C350 is Available with the Following Physical Specifications Per Roll [English Units (Metric Units)]

Width	6.50 ft (2.00 m)
Length	55.50 ft (16.90 m)
Weight ± 10%	37.00 lbs (16.80 kg)
Area	40.00 yd² (33.40 m²)

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)

Updated 1/2004

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SUPPLEMENTAL SPECIFICATION

C350

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% coconut fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be stitch bonded between a super heavy duty UV stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, a ultra heavy duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, and covered by a super heavy duty UV stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

Property	Test Method	Typical	
Thickness	ASTM D6525	0.67 in (17 mm)	
Resiliency	ASTM D1777	90%	
Density	ASTM D792	0.528 oz/in³ (0.913 g/cm³)	
Mass per Unit Area	ASTM D6566	12.57 yd² (426 g/m²)	
Porosity	ECTC Guidelines	99%	
Stiffness	ASTM D1388/ECTC	3.83 oz-in (42,710 mg-cm)	
Light Penetration	ECTC Guidelines	9.0%	
MD Tensile Strength	ASTM D6818 [D5035]	625 lbs/ft (9.12 kN/m)	[658 lbs/ft (9.60 kN/m)]
MD Elongation	ASTM D6818 [D5035]	22%	[8.50%]
TD Tensile Strength	ASTM D6818 [D5035]	768 lbs/ft (11.21 kN/m)	[910 lbs/ft (13.28 kN/m)]
TD Elongation	ASTM D6818 [D5035]	15%	[10.90%]

C350 PERMANENT TURF REINFORCMENT MATTING ONLY

Property	Test Method	Typical
Thickness	ASTM D6525	0.51 in (13 mm)
UV Stability	ASTM D4355*	86%
MD Tensile Strength	ASTM D6818 [D5035]	698 lbs/ft (10.19 kN/m) [564 lbs/ft (8.23 kN/m)]
MD Elongation	ASTM D6818 [D5035]	30% [37%]
TD Tensile Strength	ASTM D6818 [D5035]	710 lbs/ft (10.36 kN/m) [780 lbs/ft (11.38)]
TD Elongation	ASTM D6818 [D5035]	20%

*ASTM D1682 (4 inch strip) Tensile Strength and % Strength Retention of material following 1000 hrs exposure in Xenon-Arc Weatherometer; MD – Machine direction; TD – Transverse direction

Bench Scale Testing†

Test Method - Description	Parameters	Results
ECTC Method 2 – Determination of unvegetated RECP's ability to protect soil from rain splash and associated runoff	50 mm (2 in)/hr for 30 min	Soil loss ratio* = 18.32
	100 mm (4 in)/hr for 30 min	Soil loss ratio* = 19.65
	150 mm (6 in)/hr for 30 min	Soil loss ratio* = 20.48
ECTC Method 3 – Determination of unvegetated RECP's ability to protect soil from hydraulically-induced shear stress. **Failure criteria = 0.50 inch soil loss**	Shear: 4.72 lbs/ft² for 30 min	Soil loss: 127g
	Shear: 5.74 lbs/ft² for 30 min	Soil loss: 195g
	Shear: 5.91 lbs/ft² for 30 min	Soil loss: 255g
	Shear at 0.50 inch soil loss (450g)	**7.5 lbs/ft²**
ECTC Draft Method 4 – Determination of temporary RECP performance in encouraging seed germination and plant growth	Top soil; Fescue (Kentucky 31); 21 day incubation 27° C ± 2° & approximately 50% RH	Percent improvement = 243% (increased biomass)
* Soil Loss Ratio = Soil Loss with Bare Soil / Soil Loss with RECP (NOTE: Soil loss based on regression analysis)		

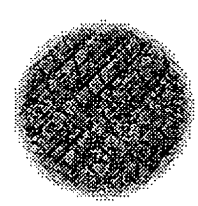
†Bench Scale Performance Testing

Bench scale tests are index property tests. These tests are not indicative of field performance and therefore should not be used in design to establish performance levels for rolled erosion control products. Bench scale tests are performed according to methods developed by the Erosion Control Technology Council (ECTC).

Updated 1/2004

PERFORMANCE SPECIFICATION

C350



The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% coconut fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be stitch bonded between a super heavy duty UV stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, a ultra duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, and covered by a super heavy duty UV stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

Slope Design Data - Unvegetated Cover Factors

	Slope Gradient (S)		
Slope Length (L)	**≤ 3:1**	**3:1-2:1**	**≥ 2:1**
≤ 20 ft (6 m)	**0.0005**	**0.015**	**0.043**
20 - 50 ft	**0.018**	**0.031**	**0.050**
≥ 50 ft (15.2 m)	**0.035**	**0.047**	**0.057**

Channel Design Data

Roughness Coefficients - Unvegetated	
Flow Depth	Manning's 'n'
≤ 0.50 ft (0.15 m)	**0.041**
0.50 - 2.00 ft	**0.040-0.013**
≥ 2.00 ft (0.60 m)	**0.012**

Approximate Maximum Flow Velocity
Unvegetated = 10.5 ft/s (3.20 m/s)
Vegetated = 20 ft/s (6.0 m/s)

Maximum Permissible Shear Stress*		
	Short Duration	Long Duration
Phase 1 UNVEGETATED	**3.20 lbs/ft² (153 Pa)**	**3.00 lbs/ft² (144 Pa)**
Phase 2 PARTIALLY VEGETATED	**10.00 lbs/ft² (480 Pa)**	**10.00 lbs/ft² (480 Pa)**
Phase 3 FULLY VEGETATED	**12.00 lbs/ft² (576 Pa)**	**10.00 lbs/ft² (480 Pa)**

Values are approximate, precise values obtained from ECMDS™

*Performance values obtained through third party testing at the Texas Transportation Institute, Colorado State University, and Utah State University based on soil loss failure criteria not exceeding 0.50 inches (1.27 cm).

NORTH AMERICAN GREEN
EROSION CONTROL Products
Guaranteed SOLUTIONS

Date: July 19, 2005
Project: Rocky Flats, Colorado
Contractor: Kaiser-Hill
Contact: Jeremy Jaramillo, EnviroCon
Material Type & Quantity: 7,720 yds^2 (193 rolls) P550 Permanent Composite Turf Reinforcement Mat

CERTIFICATE OF COMPLIANCE
NORTH AMERICAN GREEN P550 PERMANENT TURF REINFORCEMENT MAT

North American Green, Inc. certifies that the P550 Erosion Control/Turf Reinforcement Mat has the properties and characteristics detailed below:

The P550 erosion control/composite turf reinforcement mat, manufactured by North American Green, is constructed using 100% UV stabilized polypropylene fiber at a rate of 0.50 lb/yd^2 (0.27 kg/m^2) ± 10% stitch bonded between a heavy duty, UV stabilized bottom net with a minimum net weight of 24 lbs/1000 ft^2 (11.70 kg/100 m^2) and a heavy duty, UV stabilized, corrugated (crimped), intermediate netting with a minimum net weight of 24 lbs/1000 ft^2 (11.70 kg/100 m^2) overlain with a heavy duty, UV stabilized top net with a minimum net weight of 8.00 lbs/1000 ft^2 (11.70 kg/100 m^2). The corrugated (crimped) netting shall form prominent closely spaced ridges across the entire width of the mat. The three nets and polypropylene fiber matrix are sewn together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional structure. North American Green ships the P550 magenta color-coded packaging.

The blanket is manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) to ensure proper material overlapping.

The North American Green P550 erosion control/composite turf reinforcement mat (C-TRM) should be used only after proper soil preparation, fertilization and seeding. The P550 is designed to control soil loss, facilitate revegetation, and reinforce vegetation on disturbed sites. The P550 is ideal for steep slopes, channels and shoreline applications

Installation staple patterns shall be clearly marked on the turf reinforcement matting with environmentally safe paint. All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

P550 is Available with the Following Physical Specifications Per Roll [English Units (Metric Units)]

Width	6.50 ft (2.00 m)
Length	55.50 ft (16.90 m)
Weight ± 10%	52 lbs (23.59 kg)
Area	40.00 yd^2 (33.40 m^2)

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)
To the best of our knowledge, the information above is accurate.

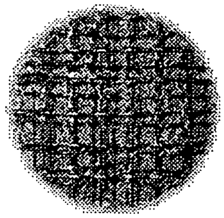
North American Green Representative
Roy J. Nelsen, CPESC

14649 Highway 41 North • Evansville, Indiana 47725 • 812-867-6632
800-772-2040 • FAX 812-8670247 • www.nagreen.com

NORTH AMERICAN GREEN®

MATERIAL SPECIFICATION

P550



The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% UV stabilized polypropylene fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between the bottom and middle ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings and then covered by an ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The middle, dramatically corrugated (crimped) netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

The P550 shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the U.S. Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications For Construction of Roads and Bridges on Federal Highway Projects, FP-03 2003 Section 713.18* as a *Type 5A, B, and C Permanent Turf Reinforcement Mat.*

Installation staple patterns shall be clearly marked on the turf reinforcement mattings with environmentally safe paint. All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The composite turf reinforcement mat shall be the North American Green P550, or equivalent. The P550 permanent composite turf reinforcement mat shall have the following physical properties:

Material Content

Matrix	100% UV Stabilized Polypropylene Fibers (0.50 lbs/yd²) (0.27 kg/m²)
Netting	Top and bottom- Ultra Heavy Duty UV Stabilized Polypropylene (24 lb/1,000 ft² [11.7 kg/100 m²] approximate weight)
	Mid – Corrugated Ultra Heavy Duty UV Stabilized Polypropylene (24 lb/1,000 ft² [11.7 kg/100 m²] approximate weight)
Thread	UV Stabilized Polypropylene

P550 is Available with the Following Physical Specifications Per Roll [English Units (Metric Units)]

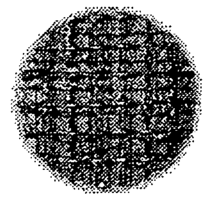
Width	6.50 ft (2.00 m)
Length	55.50 ft (16.90 m)
Weight ± 10%	52 lbs (23.59 kg)
Area	40.00 yd² (33.40 m²)

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)

NORTH AMERICAN GREEN

SUPPLEMENTAL SPECIFICATION

P550



The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% UV stabilized polypropylene fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between the bottom and middle ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings and then covered by an ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The middle, dramatically corrugated (crimped) netting shall form prominent closely spaced ridges across the entire width of the mat. The three nets shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

Property	Test Method	Typical
Thickness	ASTM D6525	0.76 in (19.30 mm)
Resiliency	ASTM D6524	95 %
Density	ASTM D792	0.528 oz/in^3 (0. 913 g/cm^3)
Mass per Unit Area	ASTM D6566	21.45 oz/yd^2 (728 g/m^2)
Porosity	ECTC Guidelines	96 %
Open Volume/Unit Area	ECTC Guidelines	122,906 in^3/yd^2 (1,684,589 cm^3/m^2)
Stiffness	ASTM D1388/ECTC	366.27 oz-in (4,087,934 mg-cm)
Light Penetration	ECTC Guidelines	16 %
UV Stability	ASTM D4355*	100%
MD Tensile Strength	ASTM D6818 [ASTM D5035]	763 lbs/ft (11.15 kN/m) [1381 lbs/ft (20.15 kN/m)]
MD Elongation	ASTM D6818 [ASTM D5035]	10 % [13 %]
TD Tensile Strength	ASTM D6818 [ASTM D5035]	1134 lbs/ft (16.55 kN/m) [1523 lbs/ft (22.23 kN/m)]
TD Elongation	ASTM D6818 [ASTM D5035]	11% [13 %]

*ASTM D1682 (4 inch strip) Tensile Strength and percent Strength Retention of material following 1000 hrs exposure in Xenon-Arc Weatherometer.
MD – Machine direction
TD – Transverse direction

Bench Scale Testing†

Test Method - Description	Parameters	Results
ECTC Method 2 – Determination of unvegetated RECP's ability to protect soil from rain splash and associated runoff	50 mm (2 in)/hr for 30 min	Soil loss ratio* = 10.79
	100 mm (4 in)/hr for 30 min	Soil loss ratio* = 9.98
	150 mm (6 in)/hr for 30 min	Soil loss ratio* = 9.53
ECTC Method 3 – Determination of unvegetated RECP's ability to protect soil from hydraulically-induced shear stress. **Failure criteria = 0.50 inch soil loss**	Shear: 4.48 lbs/ft^2 for 30 min	Soil loss: 262g
	Shear: 5.14 lbs/ft^2 for 30 min	Soil loss: 445g
	Shear: 5.64 lbs/ft^2 for 30 min	Soil loss: 645g
	Shear at 0.50 inch soil loss (450g)	**5.1 lbs/ft^2**
ECTC Draft Method 4 – Determination of temporary RECP performance in encouraging seed germination and plant growth	Top soil; Fescue (Kentucky 31); 21 day incubation 27° C ± 2° & approximately 50% RH	Percent improvement = 354% (increased biomass)
* Soil Loss Ratio = Soil Loss with Bare Soil / Soil Loss with RECP (NOTE: Soil loss based on regression analysis)		

†Bench Scale Performance Testing

Bench scale tests are index property tests. These tests are not indicative of field performance and therefore should not be used in design to establish performance levels for rolled erosion control products. Bench scale tests are performed according to methods developed by the Erosion Control Technology Council (ECTC).

Updated 1/2004

NORTH AMERICAN GREEN®

PERFORMANCE SPECIFICATION

P550

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 100% UV stabilized polypropylene fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.
The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between the bottom and middle ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings and then covered by an ultra heavy duty UV stabilized nettings with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The middle, dramatically corrugated (crimped) netting shall form prominent closely spaced ridges across the entire width of the mat. The three nets shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

Slope Design Data - Unvegetated Cover Factors

	Slope Gradient (S)		
Slope Length (L)	≤ 3:1	3:1-2:1	≥ 2:1
≤ 20 ft (6 m)	**0.00045**	**0.0145**	**0.0425**
20 - 50 ft	**0.0173**	**0.0305**	**0.0495**
≥ 50 ft (15.2 m)	**0.0345**	**0.0465**	**0.0565**

Channel Design Data

Roughness Coefficients - Unvegetated	
Flow Depth	Manning's 'n'
≤ 0.50 ft (0.15 m)	**0.041**
0.50 - 2.00 ft	**0.040 - 0.014**
≥ 2.00 ft (0.60 m)	**0.013**

Approximate Maximum Flow Velocity
Unvegetated = 12.5 ft/s (3.8 m/s)
Vegetated = 25 ft/s (7.6 m/s)

Maximum Permissible Shear Stress		
	Short Duration	Long Duration
Phase 1 UNVEGETATED	**4.0 lbs/ft²** **(191 Pa)**	**3.25 lbs/ft²** **(156 Pa)**
Phase 2 PARTIALLY VEGETATED	**12.0 lbs/ft²** **(576 Pa)**	**12.0 lbs/ft²** **(576 Pa)**
Phase 3 FULLY VEGETATED	**14.0 lbs/ft²** **(672 Pa)**	**12.0 lbs/ft²** **(576 Pa)**

Values are approximate, precise values can be obtained using ECMDS™

*Performance values obtained through third party testing at the Texas Transportation Institute, Colorado State University, and Utah State University based on soil loss failure criteria not exceeding 0.50 inches (1.27 cm).

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✓

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURERS CERTIFICATES OF COMPLIANCE	TRANSMITTAL NO.: OLF-013 DATE: 7/28/05
To: Mike Keating (K-H) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200	From: Steven McQueary (Envirocon) Rocky Flats Environmental Technology Site 10808 Hwy. 93, Unit B Golden, CO 80403-8200
Specification Sec. No. General Project	**Project Title and Location:** Cover Original Landfill - Rocky Flats

Item No.	Description of Item Submitted	No. of Copies	Spec. Para. No.	Drawing Sheet No.	Variation
1	NAG C125 BioNet™ Erosion Mat Cert. of Compliance, Material Specifications and Performance Specification	3	02227-0986	N/A	N/A

REMARKS

OK
CQAE
JHRala TX

I certify that the above submitted items have been reviewed in detail and are correct and in strict compliance with the contract drawings and specifications except as otherwise noted.

Steven McQueary [signature]
NAME AND SIGNATURE OF CONTRACTOR

- ☐ APPROVED
- ☐ APPROVED AS CORRECTED
- ☐ NOT APPROVED
- ☐ REVISE AND RESUBMIT

Approval is for conformance to the approved design, including the calculations, plans, construction quality assurance plan, and specifications.

AUTHORITY	DATE

SITE QA MANAGER / DATE

MKeating 7/28/05

RESPONSIBLE MANAGER DATE

NORTH AMERICAN GREEN

MATERIAL SPECIFICATION

C125BN

The long-term coconut fiber erosion control blanket shall be a machine-produced 100% biodegradable blanket with a 100% coconut fiber matrix with a functional longevity of up to 24 months (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographic location, and elevation).

The blanket shall be of consistent thickness with the coconut fiber evenly distributed over the entire area of the blanket. The blanket shall be covered on the top and bottom sides with 100% biodegradable woven, natural, organic fiber netting. The top netting shall consist of machine directional strands formed from two intertwined yarns with cross directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form an approximate 0.50 x 1.00 inch (1.27 x 2.54 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers (50 stitches per roll width) with biodegradable thread.

The C125BN shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the U.S. Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications For Construction of Roads and Bridges on Federal Highway Projects, FP-03 2003 Section 713.17* as a *Type 4. Long-term Erosion Control Blanket.*

The C125BN is also available upon request with the DOT System™. The DOT System™ consists of installation staple patterns clearly marked on the erosion control blanket with environmentally safe paint. The blanket shall be manufactured with a colored line or thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) to ensure proper material overlapping.

The long-term erosion control blanket shall be C125BN as manufactured by North American Green, or equivalent.

The coconut fiber erosion control blanket shall have the following properties:

Material Content

Matrix	100% coconut fiber (0.50 lb/yd²) (0.27 kg/m²)
Netting	Top - Leno woven 100% biodegradable organic jute fiber (9.30 lbs/1,000 ft² [4.50 kg/100 m²] approximate weight) Bottom - 100% biodegradable organic jute fiber (7.7 lbs/1,000 ft² [3.76 kg/100 m²] approximate weight)
Thread	Biodegradable

C125BN is Available with the Following Physical Specifications Per Roll [English Units (Metric Units)]

Width ± 5%	6.67 ft (2.03 m)
Length ± 5%	108.00 ft (32.92 m)
Weight ± 10%	52.22 lbs (23.69 kg)
Area	80.00 yd² (66.89 m²)

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)

Updated 1/2004

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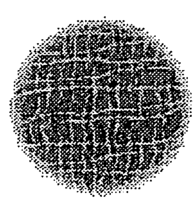
NORTH AMERICAN GREEN

SUPPLEMENTAL SPECIFICATION



C125BN

The North American Green C125BN long-term erosion control blanket is constructed of 100% biodegradable materials containing a 100% coconut fiber matrix and has a functional longevity of up to 24 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographic location, and elevation). The coconut fiber shall be evenly distributed over the entire area of the blanket. The blanket shall be covered on the top and bottom with 100% biodegradable natural organic fiber netting woven into an approximate 0.50 x 1.00 inch (1.27 x 2.54 cm) mesh. The blanket shall be sewn together with biodegradable thread on 1.50 inch (3.81 cm) centers. The following list contains further physical properties of the C125BN erosion control blanket.

Property	Test Method	Typical
Thickness	ASTM D5199/ECTC	0.26 in (6.60 mm)
Resiliency	ECTC Guidelines	85%
Mass per Unit Area	ASTM D6475	8.83 oz/yd^2 (300 g/m^2)
Water Absorption	ASTM D1117/ECTC	155%
Swell	ECTC Guidelines	40%
Stiffness/Flexibility	ASTM D1388/ECTC	0.11 oz-in (1,218 mg-cm)
Light Penetration	ECTC Guidelines	16.40%
Smolder Resistance	ECTC Guidelines	Yes**
MD Tensile Strength	ASTM D5035	342.00 lbs/ft (4.98 kN/m)
MD Elongation	ASTM D5035	7.60%
TD Tensile Strength	ASTM D5035	211.00 lbs/ft (3.08 kN/m)
TD Elongation	ASTM D5035	11.10%

**Material is smolder resistant according to specified test
MD – Machine Direction
TD – Transverse Direction

Bench Scale Testing†

Test Method - Description	Parameters	Results
ECTC Method 2 – Determination of unvegetated RECP's ability to protect soil from rain splash and associated runoff	50 mm (2 in)/hr for 30 min	Soil loss ratio* = 6.83
	100 mm (4 in)/hr for 30 min	Soil loss ratio* = 10.76
	150 mm (6 in)/hr for 30 min	Soil loss ratio* = 16.95
ECTC Method 3 – Determination of unvegetated RECP's ability to protect soil from hydraulically-induced shear stress.	Shear: 1.40 lbs/ft^2 for 30 min	Soil loss: 370g
	Shear: 2.06 lbs/ft^2 for 30 min	Soil loss: 996g
	Shear: 2.73 lbs/ft^2 for 30 min	Soil loss: 1578g
Failure criteria = 0.50 inch soil loss	**Shear at 0.50 inch soil loss (450g)**	**3.13 lbs/ft^2**
ECTC Draft Method 4 – Determination of temporary RECP performance in encouraging seed germination and plant growth	Top soil; Fescue (Kentucky 31); 21 day incubation 27° C ± 2° & approximately 50% RH	Percent improvement = 401% (increased biomass)
* Soil Loss Ratio = Soil Loss with Bare Soil / Soil Loss with RECP (NOTE: Soil loss based on regression analysis)		

†Bench Scale Testing
Bench scale tests are index property tests. These tests are not indicative of field performance and therefore should not be used in design to establish performance levels for rolled erosion control products. Bench scale tests are performed according to methods developed by the Erosion Control Technology Council (ECTC).

Updated 1/2004

NORTH AMERICAN GREEN®

EROSION CONTROL Products
Guaranteed SOLUTIONS

Date: July 22, 2005
Project: Rocky Flats, Colorado
Contractor: Kaiser-Hill
Contact: Jeremy Jaramillo, EnviroCon
Material Type & Quantity: 9,600 yds² (120 rolls) C125 BioNet™ Long-Term Coconut Erosion Control Blanket

CERTIFICATE OF COMPLIANCE
NORTH AMERICAN GREEN C125 BioNet™ 100% BIODEGRADABLE LONG-TERM EROSION CONTROL BLANKET

North American Green, Inc. certifies that the C125BN 100% Biodegradable Long-Term Erosion Control Blanket and Channel Liner has the properties and characteristics listed below:

The C125BN long-term erosion control blanket and channel liner manufactured by North American Green is a 100% biodegradable mat using a 100% coconut matrix at a rate of 0.50 lbs/yd² (0.27 kg/m²). The C125BN is covered, on both the top and bottom sides, with netting made from 100% biodegradable natural organic fiber. The top netting shall consist of machine directional strands formed from two intertwined yarns with cross-directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form an approximate 0.50 x 1.00 inch (1.27 x 2.54 cm) mesh. The bottom netting shall be a standard cross-lay jute net. Minimum weight for the top net is 9.30 lbs/1,000 ft² [4.50 kg/100 m²] and minimum weight for the bottom net is 7.7 lbs/1,000 ft² [3.76 kg/100 m²]. The coconut fiber and netting are sewn together with biodegradable thread on 1.50 inch (3.81 cm) centers. The C125BN is shipped in color-coded dark brown packaging with black sidebars.

The North American Green C125BN 100% biodegradable erosion control blanket and channel liner should be used following proper soil preparation, fertilization, and seeding. The C125BN is designed to temporarily control soil erosion on newly seeded areas until vegetation growth can occur. The C125BN erosion control blankets are appropriate for use on steep slopes, high-discharge channels, and shoreline applications.

Installation staple patterns shall be clearly marked on the erosion control blankets with environmentally safe paint. All blankets shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

C125BN is Available with the Following Physical Specifications Per Roll [English Units (Metric Units)]

Width ± 5%	6.67 ft (2.03 m)
Length ± 5%	108.00 ft (32.92 m)
Weight ± 10%	52.22 lbs (23.69 kg)
Area	80.00 yd² (66.89 m²)

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)

To the best of our knowledge, the information above is accurate.

North American Green Representative
Roy J. Nelsen, CPESC

14649 Highway 41 North • Evansville, Indiana 47725 • 812-867-6632
800-772-2040 • FAX 812-8670247 • www.nagreen.com

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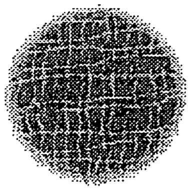
NORTH AMERICAN GREEN®

PERFORMANCE SPECIFICATION



C125BN

The North American Green C125BN erosion control blanket is constructed of 100% biodegradable materials containing a 100% coconut fiber matrix and has a functional longevity of approximately 24 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographic location, and elevation). The coconut fiber shall be evenly distributed over the entire area of the mat. The blanket shall be covered on the top and bottom with 100% biodegradable natural organic fiber netting woven into an approximate 0.50 x 1.00 inch (1.27 x 2.54 cm) mesh. The blanket shall be sewn together with biodegradable thread on 1.50 inch (3.81 cm) centers. The following list contains further physical properties of the C125BN erosion control blanket.

Property	Test Method	Typical
Thickness	ASTM D5199/ECTC	0.26 in (6.60 mm)
Resiliency	ECTC Guidelines	85 %
Mass per Unit Area	ASTM D6475	8.83 oz/yd^2 (300 g/m^2)
Water Absorption	ASTM D1117/ECTC	155 %
Swell	ECTC Guidelines	40 %
Stiffness/Flexibility	ASTM D1388/ECTC	0.11 oz-in (1,218 mg-cm)
Light Penetration	ECTC Guidelines	16.40 %
Smolder Resistance	ECTC Guidelines	Yes**
MD Tensile Strength	ASTM D5035	342 lbs/ft (4.98 kN/m)
MD Elongation	ASTM D5035	7.60 %
TD Tensile Strength	ASTM D5035	211 lbs/ft (3.08 kN/m)
TD Elongation	ASTM D5035	11.10 %

**Material is smolder resistant according to specified test
MD – Machine Direction
TD – Transverse Direction

Slope Design Data

Cover Factors (C)			
	Slope Gradient (S)		
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1
≤ 20 ft (6 m)	0.00009	0.018	0.050
20 – 50	0.003	0.040	0.060
≥ 50 ft (15.2 m)	0.007	0.070	0.070

Channel Design Data

Channel Roughness Coefficients	
Flow Depth	Manning's 'n'
≤ 0.50 ft (0.15 m)	0.022
0.50-2.00 ft	0.022-0.014
≥ 2.00 ft (0.60 m)	0.014
Max. Permissible Shear Stress 2.35 lbs/ft^2 (112.0 Pa)	

For most accurate design data consult ECMDS™
Manning's 'n' expressed in English units for unvegetated blankets

Bench Scale Testing†

Unvegetated Channel	3.2 lbs/ft^2

Approximate Max Flow Velocity
10.00 ft/s (3.05 m/s)

†Bench Scale Testing

Bench scale tests are index property tests. These tests are not indicative of field performance and therefore should not be used in design to establish performance levels for rolled erosion control products. Bench scale tests are performed according to methods developed by the Erosion Control Technology Council (ECTC).

APPENDIX E
CONSTRUCTION REQUESTS FOR INFORMATION AND ENGINEERING CHANGE REQUESTS

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APPENDIX E-1: REQUESTS FOR INFORMATION

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0140

RFI'S REGISTER

PROJECT Cover Original Landfill
JOB NUMBER T0113090
LOCATION RFETS

PAGE 1 of
DATE

Section Description	Section No.	Para. No.	Component	Description of Item	Transmittal No.	Submittal Classification [1]	Submission Date	Approval Date	Remarks
BUTTRESS FOOTING	N/A	N/A		CLARIFY DRAIN ROCK DEPTH	001	D	5/16/2005	5/16/2005	
BUTTRESS	N/A	N/A		DEPTH 72' IN BUTTROSS	002		5/16/2005	5/16/2005	
GEOGRID	N/A	N/A		CLARIFY ANCHOR	003		5/16/2005	5/16/2005	
GEOGRID	N/A	N/A		~~USE [illegible]~~ MATERIAL FOR REGRADE	004		5/17/2005	5-17-05	
BUTTRESS	3.03	A		TOLERANCE FOR TOE BUTTRESS	005	QA	5-24-05	5-25-05	
GEOTEXTILE	DRAWING 51788-011			ANCHOR GEOTEXTILE	006	QA	5-24-05	6-1-05	
EARTHWORK	1.02	B		REGRADE MATERIAL	007		5-27-05	6-15-05	
DRAWING # 51788-006	N/A	N/A	N/A	TIE-IN NEAR GASLINE	008	D	6-7-05	6-8-05	
DRAWING # 51788-003	N/A	N/A	N/A	BUTTRESS BACKSLOPE	009	D	6-16-05	6-20-05	
DRAWING # 51788 - ~~00~~ 007	N/A	N/A	N/A	GRADE BREAK ELEVATION CHANGE	010	D	~~6-7-05~~ 7-6-05	7-13-05	
DRAWING # 51788-005	N/A	N/A	N/A	DELINEATE SG-2 WASTE AREA	011	FIO	7-20-05	7-20-05	
DRAWING # 51788-009	N/A	N/A	N/A	GRADE FOR DIVERSION #3	012	D	7-20-05	7-20-05	
DRAWING # 51788 . 12A	N/A	N/A	N/A	CHANNEL ELEVATIONS/DIVERSION BERM SLOPE	013	D	7-25-05	7-27-05	
GENERAL PROJECT	N/A	N/A	N/A	SEEP UNDER DIVERSION BERM 3	14	D	7-28-05		→ Changed to ECR
EROSION MATTING	02273			EROSION MAT STAPLES/STAKES	15	D	7-28-05	8-3-05	
Erosion Matting				DIVERSION CHANNEL ANCHOR	16	D	8-3-05	8-3-05	
Erosion Matting				C125 on Buttress 3:1	17		8-18-05	8-22-05	
Buttress				~~Chan~~ Adjust EL. of Pt 125	18		8-18-05	9-6-05	
EROSION MATTING				CHANGE TO USE C125	19		8-30-05	8-30-05	

[1] Submittals shall be classified as D (Designer of Record Approval), QA (CQAE Approval), or FIO (For Information Only).

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	001
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	5/16/2005
		REPLY DATE	5/17/2005

TO	RANDY THOMPSON	COMPANY	EARTH-TECH.
SUBJECT	BUTTRESS FOOTING	LOCATION	ROCKY FLATS OLF
DRAWING NO.	51788-011 REV.0	SPEC. NO.	N/A

INFORMATION REQUESTED:

DETAIL ON DRAWING 51788-011 INDICATES THE BUTTRESS FOOTING WITH ONE FOOT DRAIN ROCK. SHOULD THIS BE TWO FOOT MINIMUM DEPTH AS INDICATED IN PREVIOUS DRAFT COPIES?

REPLY REQUIRED BY 5/17/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

Steven L. Mc[illegible]
CONTRACTOR REP SIGNATURE

5-16-05
DATE

POTENTIAL IMPACT NOTICE
- X SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

THE DETAIL ON DRAWING 51788-011 IS CORRECT. THE BUTTRESS FOOTING MUST CONSIST OF A MINIMUM ONE FOOT THICKNESS OF DRAIN ROCK.

J McKeating
RM

5/16/05
DATE

[illegible]
DM

5/17/05
DATE

[illegible]
CQAE

5/17/05
DATE

NA
CDPHE REPRESENTATIVE

DATE

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REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	002
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	5/16/2005
		REPLY DATE	5/17/2005

TO	RANDY THOMPSON	COMPANY	EARTH-TECH.
SUBJECT	BUTTRESS	LOCATION	ROCKY FLATS OLF
DRAWING NO.	51788-011	SPEC. NO.	N/A

INFORMATION REQUESTED:

DEPTH OF BUTTRESS EXCAVATION MAY VARY. PLEASE PROVIDE MORE DETAIL IF DEPTH OF EXCAVATION IS GREATER THAN TWO FEET, WITH RESPECT TO TIE IN OF NATURAL FINE.

REPLY REQUIRED BY 5/17/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE
X SCHEDULE
X LABOR
X MATERIAL
__ NO IMPACT
__ OTHER ________

CONTRACTOR REP SIGNATURE — DATE 5-16-05

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

SEE ATTACHED DRAWING WITH DETAILS CLARIFYING THE TWO SCENARIOS: 1) DEPTH OF EXCAVATION GREATER THAN 2 FT, AND 2) DEPTH OF EXCAVATION LESS THAN 2 FT.

IN GENERAL, THE TOE OF THE PIT-FINE BUTTRESS MATERIAL MUST BE 2 FT BELOW THE EXISTING GRADE. IF THE EXCAVATION IS DEEPER, DRAIN ROCK MAY BE USED TO FILL THE EXCAVATION UP TO THE 2-FT DEEP PIT-FINE FOOTING.

RM J M Keating — DATE 5/16/05

DM — DATE 5/17/05

COAE — DATE 5/17/05

CDPHE REPRESENTATIVE N/A — DATE

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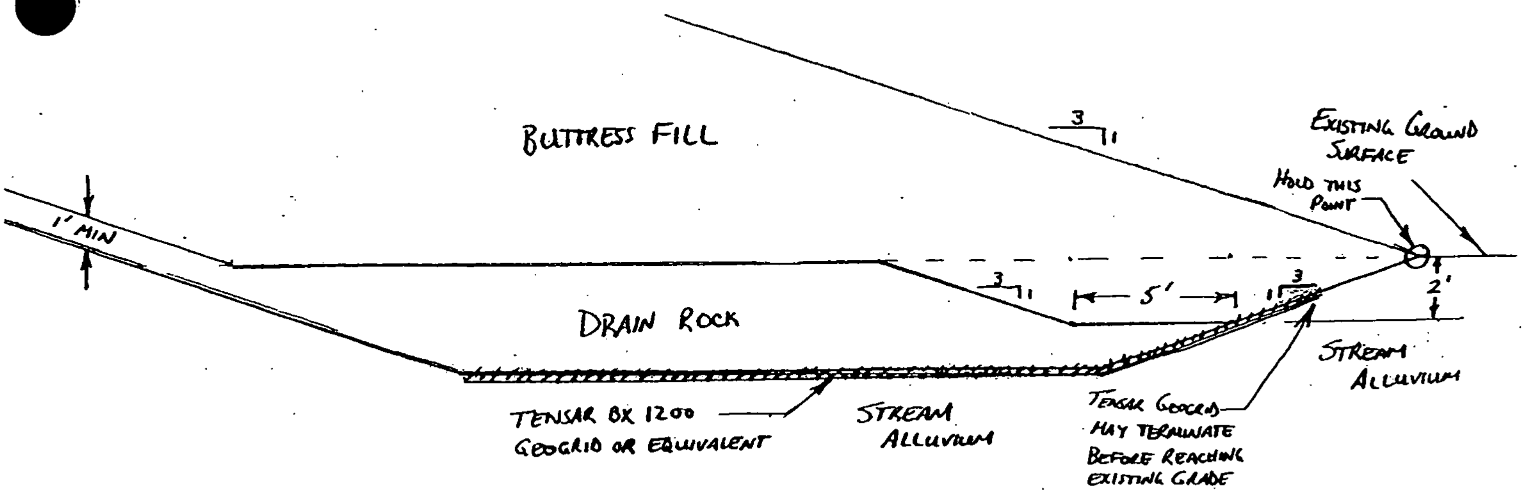
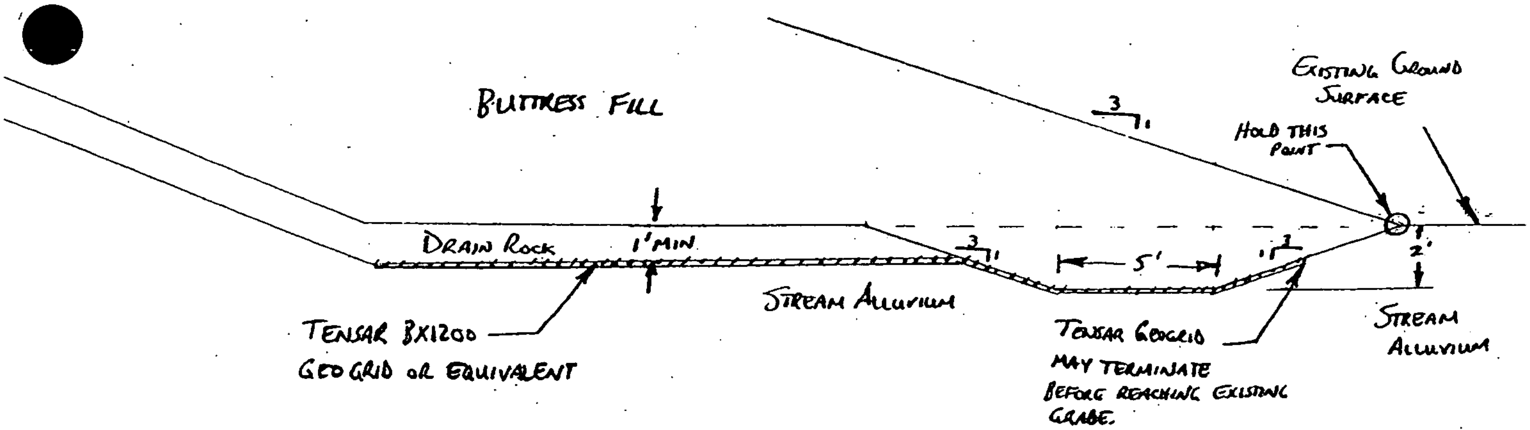
TWO SCENARIOS

1) SUBGRADE EXCAVATION GREATER THAN 2 FT:



2) SUBGRADE EXCAVATION LESS THAN 2 FT:



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REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	003
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	5/16/2005
		REPLY DATE	5/17/2005

TO	RANDY THOMPSON	COMPANY	EARTH-TECH.
SUBJECT	GEOGRID	LOCATION	ROCKY FLATS OLF
DRAWING NO.	51788-011	SPEC. NO.	N/A

INFORMATION REQUESTED:

ANCHOR TRENCH FOR TENSAR BX1200 IS EM BEDDED AT EXISTING GROUND SURFACE. WOULD LIKE TO PROPOSE ANCHOR APPROXIMATELY ONE FOOT BELOW EXISTING ELEVATION TO PREVENT ULTRA VIOLET LIGHT DETERIORATION.

REPLY REQUIRED BY 5/17/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE
X SCHEDULE
X LABOR
X MATERIAL
__ NO IMPACT
__ OTHER ____________

CONTRACTOR REP SIGNATURE ____________ DATE 5-16-05

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

APPROVED. GEOGRID MATERIAL MAY TERMINATE BEFORE DAYLIGHTING INTO EXISTING GROUND SURFACE.

RM ____________ DATE 5/16/05

DM ____________ DATE 5/17/05

CQAE ____________ DATE 5/17/05

N/A

CDPHE REPRESENTATIVE ____________ DATE

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	004
JOB NUMBER	T0113090	PAGE	1 OF 6
LOCATION	RFETS	RFI DATE	5/17/2005
		REPLY DATE	5/18/2005

TO	RANDY THOMPSON	COMPANY	EARTH-TECH.
SUBJECT	GEOGRID	LOCATION	ROCKY FLATS OLF
DRAWING NO.	51788-011	SPEC. NO.	N/A

INFORMATION REQUESTED:

DRAWINGS SPECIFY USE OF TENSAR BX1200 OR EQUIVALENT STRUCTURAL GEOGRID. WE ARE PROPOSING THE USE OF SYNTECH TECHNICAL FABRICS SF12 AS AN EQUIVALENT. SEE ATTACHED DATA SHEETS.

REPLY REQUIRED BY 5/18/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

Steven L McL

CONTRACTOR REP SIGNATURE

5-17-05

DATE

POTENTIAL IMPACT NOTICE
- X SCHEDULE
- _ LABOR
- X MATERIAL
- _ NO IMPACT
- _ OTHER ____________

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

SF 12 EXCEEDS THE STRENGTH SPECIFICATIONS OF TENSAR BX 1200 IN ALL CATEGORIES EXCEPT THE LOAD AT 5% STRAIN IN THE TRANSVERSE DIRECTION. (SF 12: 1,129 lbs/ft, TENSAR BX 1200: 1,340 lbs/ft). THE DIFFERENCE IS LESS THAN 16%. The SF 12 MATERIAL CAN BE DEEMED "EQUIVALENT."

24" overlap @ install. - use 3' Min overlap w/ ties in soft, wet areas JHR

JM Keating

RM

5/17/05

DATE

DM

5/17/05

DATE

J H R

CQAE

5/17/05

DATE

N/A

CDPHE REPRESENTATIVE

DATE

245

Synteen

www.synteen.com

May 17, 2005

Kaiser-Hill Company
Mr. Steve McQueary

Re: Original Landfill

This letter is to certify that SF Series geogrids as manufactured by Synteen Technical Fabrics meets or exceeds the standards for geogrids as set by FWHA, NCMA and other industry groups. **All geogrids use 100% virgin resin with NO regrind material. The polyester yarn has a molecular weight of 25,000 and a CEG of less than 30.**

SF 12 is composed of high molecular weight, high tenacity multifilament polyester yarns that are woven Into a stable network placed under tension. The yarns used by STF meet the requirements for molecular weight and CEG's as established by The Geosynthetic Research Institute. The high strength polyester yarns are coated with a PVC material. SF Series Geogrids are inert to biological degradation and are resistant to naturally encountered chemicals, alkalis and acids. SF Series Geogrids are typically used for soil reinforcement applications such as retaining walls, steep slopes, embankments, sub-grade stabilization, And embankments over soft soils and waste containment applications.

REINFORCEMENT PROPERTIES SF 12		TEST METHOD	MARV VALUES lbs/ft	kN/m
Ultimate Strength	MD XMD	ASTM -6637	2388 5268	34.9 76.8
Initial Modulus	MD XMD	ASTM-6637	178,000 235,000	2598 2524
Load @ 2% Strain	MD XMD	ASTM-6637	526 797	7.7 11.6
Load @ 5% Strain	MD XMD	ASTM-6637	1042 1129	15.2 16.5
Coeffecient of Interaction		ASTM 6706 Sandy Gravel Sand	 Ci= 1.0 Ci= 1.0	

Synteen Technical Fabrics has tested our geogrids in accordance with FHWA, NCMA and GRI GG4b, 10,000 hour creep testing, GRI GG2 junction testing. Coefficient of interaction and geogrid pull out testing in accordance with GRI GG5 and installation damages testing WSDOT Method 925. In addition, STF has performed NCMA connection testing with several segmental wall systems. Reduction factors listed above are all based on specific testing. All SF Series geogrids are delivered in UV protected wrap. Labels are attached to the grid rolls indicating geogrid style and roll number. The roll number is recorded in our QC lab. All physical test data is filed according to roll numbers.

Don D Show
Vice President of Sales

Synteen Technical Fabrics, Inc.

1950 West Meeting Street • Lancaster, SC 29720 • Phone (803) 416-6336 • Fax (803) 416-6344

fhwa35.doc/a

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SF 12 Synteen

PAVEMENT STRUCTURES

SYNTEEN BASE COURSE REINFORCEMENT
SUBGRADE IMPROVEMENT BIAXIAL GEOGRID

SF 12 is composed of high molecular weight, high tenacity multifilament polyester yarns that are woven into a stable network placed under tension. The high strength polyester yarns are coated with a polymer coating. SF Geogrids are inert to biological degradation and are resistant to naturally encountered chemicals, alkalis and acids.

SF12 INCREASES THE SERVICE LIFE OF PAVEMENT STRUCTURES BY IMPROVING:

CONFINEMENT OF BASE COURSE

1. Prevents lateral spreading of the base or sub-base aggregate
2. Allows for shear interaction to develop between the aggregate and the geogrid

INCREASE TENSILE STRENGTH OF AGGREGATE

1. SF 12 geogrid will reduce applied vertical pressure of heavy loads at depth of aggregate by spreading the load over a wider area.

REINFORCEMENT PROPERTIES		TEST METHOD	MARV VALUES lbs/ft	kN/m
Ultimate Strength	MD XMD	ASTM-6637	2388 5268	34.9 76.8
Initial Modulus	MD XMD	ASTM-6637	178,000 235,000	2598 3432
Load at 2% Strain	MD XMD	ASTM-6637	526 797	7.7 11.6
Load at 5% Strain	MD XMD	ASTM-6637	1042 1129	15.2 16.5
True in place strength after site damage testing based on TRI method of "installation" damage testing with coarse gravel (GP) and sandy gravel (SW).				
Load at 2% Strain	MD (GP) MD (SW)	ASTM 6637 + ASTM 5818	438 496	6.3 7.2
Load at 2% Strain	XMD (GP) XMD (SW)	ASTM 6637 + ASTM-5818	664 752	9.7 11.0
Load at 5% Strain	MD (GP) MD (SW)	ASTM 6637 + ASTM-5818	868 983	12.6 14.3
Load at 5 % Strain	XMD (GP) XMD (SW)	ASTM 6637 + ASTM-5818	940 1065	13.7 15.5
Coefficient of Pullout Interaction		ASTM 6706 Sandy Gravel Sand	 Ci= 1.0 Ci= 1.0	
Aperture Size		Measured	MD 1.0 in. XD 1.0 in.	

*Synteen has the capacity to make apertures to specific sizes
Standard roll size: 12' x 150'. STF can produce Master Roll lengths as well.

GP= Poorly Graded Gravel
SW= Well Groomed Gravel

Synteen Technical Fabrics
1950 West Meeting Street
Lancaster, SC 29720

COMPARISON OF SF 12, BX 1200, BasXgrid 12 and Fornit 30

SF 12 / BX 1200

[illegible]	[illegible]	TRUE 2% IN PLACE STRENGTH AFTER INSTALLATION DAMAGE(LBS/FT)*	[illegible]	[illegible]	TRUE IN PLACE LOAD AT 2% AFTER REDUCTION FOR INSTALLATION DAMAGE(LBS/FT)*
MD	628	438	MD	410	353
XD	797	664	XD	620	533

[illegible]	[illegible]		[illegible]	[illegible]	
MD	628	496	MD	410	385
XD	797	752	XD	620	552

SF 12 / BasXgrid12

[illegible]	[illegible]	TRUE 2% IN PLACE STRENGTH AFTER INSTALLATION DAMAGE(LBS/FT)	[illegible]	[illegible]	TRUE IN PLACE LOAD AT 2% AFTER REDUCTION FOR INSTALLATION DAMAGE(LBS/FT)***
MD	626	438	MD	500	Not Available
XD	797	664	XD	750	Not Available

[illegible]	[illegible]		[illegible]	[illegible]	
MD	521	496	MD	500	Not Available
XD	797	752	XD	750	Not Available

SF 12 / Fornit 30

[illegible]	[illegible]	TRUE 2% IN PLACE STRENGTH AFTER INSTALLATION DAMAGE(LBS/FT)	[illegible]	[illegible]	TRUE IN PLACE LOAD AT 2% AFTER REDUCTION FOR INSTALLATION DAMAGE(LBS/FT)#
MD	626	438	MD	411	294
XD	797	664	XD	685	420

[illegible]	[illegible]		[illegible]	[illegible]	
MD	526	496	MD	411	283
XD	797	752	XD	685	435

GP=Poorly Graded Gravel
SW=Well Groomed Gravel

*Based on Actual Installation Damage Testing
**Based on Reduction from Data Sheet at www.Tensarcorp.com on 12/16/03
*** Information not available
#Based on Reduction from Data Sheet at www.Huesker.com on 12/16/03

Synteen Technical Fabrics

The design engineers for base course reinforcement and stabilization have used a 2% strain value for the bench mark of grid products. The FHWA and GRI both have done research on geogrids for soil reinforcement applications such as slopes, embankments and retaining wall applications. It is widely accepted that design strengths of geogrids for these applications must include reduction factors for long term creep, durability and INSTALLATION DAMAGE. If design engineers use safety factors to achieve Design Strengths, then it would seem logical that the true 2% value needs to have a safety factor for installation damage.

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Synteen www.synteen.com

INSTALLATION GUIDELINES

SF Base Reinforcement GEOGRIDS

Material Identification:

Each roll of SF Series geogrid will be wrapped with a plastic shrink-wrap. Each roll of material will have a label on the wrap that will show product code (SF 11 or SF 12) This label will have Roll Number, size and date of production.

Material Handling.

It is suggested that if a project requires several types of grid, the contractor color-code the grid styles to avoid the wrong grid being placed. The contractor should avoid obvious conditions that will damage the integrity of the geogrid. Do not drive equipment directly on the grid; do not use the grid as a staging mat for tools or other materials. The geogrid should be considered structural material and care needs to be used to avoid any damage to the grid.

Geogrid Placement:

The area that the geogrid is placed should be cleared of any objects that will create a void condition. The geogrids needs to be in direct contact with the soil. It is suggested that the geogrid be placed in accordance with the contract drawings. It is critical that the correct geogrid be placed at the elevations shown on the contract documents. Some tension on the geogrid is required prior to the placement of the fill material. The geogrid should be smooth and free of wrinkles. Any method of tension is acceptable. DO NOT DAMAGE THE GEOGRID WITH WOOD STAKES OR OTHER TYPE OF MECHANICAL FASTENERS. If staples or stakes are used, they need to be placed through the openings of the geogrid. Tension should be maintained until soil cover is compacted.

The geogrid shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic. Adjacent geogrid rolls shall be overlapped, or joined as required in the plans. Overlaps shall be in the direction as shown on the plans. See table below for suggested overlap requirements for adjacent rolls and at end of rolls.

Soil CBR	Method of Joining
Greater than 3	300 mm (12 in) overlap
1 – 3	600 mm (24 in) overlap
0.5 – 1	900 mm (36 in) overlap or w/ mechanical ties
Less than 0.5	1000 mm (40 in) w/ Mechanical Ties or Bodkin

Min.

Use in soft, wet areas

Synteen Technical Fabrics, Inc.

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Placement of fill material:

Control of the fill placement should be performed using the standard method utilized in the contract as defined in the project specifications or as directed by the engineer. Care

should be taken to prevent wrinkles and/or movement of the geogrid during fills placement and spreading. When practical, fill is to be placed in the direction in which the reinforcement was laid out, to aid tensioning. Rubber-tired equipment is allowed to pass over bare reinforcement at slow speeds, (less than 10 mph) and without sudden braking. Track equipment should not be allowed onto uncovered reinforcement. To avoid damaging the reinforcement, a minimum of six inches of fill on top of the reinforcement shall be placed before tracked equipment can be operated.

Tension should be maintained in the geogrid until at least 70 percent of the grid area is covered with fill. Proper tensioning is required to minimize facing movement for reinforced soil structures. **The geogrid should not be spliced.**

Tensar.

Tensar Earth Technologies, Inc.
5883 Glenridge Drive, Suite 200
Atlanta, Georgia 30328-5363
Phone: (800) 836-7271
www.tensarcorp.com

Product Specification - Biaxial Geogrid BX1200

Tensar Earth Technologies, Inc. reserves the right to change its product specifications at any time. It is the responsibility of the specifier and purchaser to ensure that product specifications used for design and procurement purposes are current and consistent with the products used in each instance. Please contact Tensar Earth Technologies, Inc. at 800-836-7271 for assistance

Product Type:	**Integrally Formed Biaxial Geogrid**
Polymer:	**Polypropylene**
Load Transfer Mechanism:	**Positive Mechanical Interlock**
Primary Applications:	**Spectra System (Base Reinforcement, Subgrade Improvement)**

Product Properties

Index Properties	**Units**	**MD Values[1]**	**XMD Values[1]**
• Aperture Dimensions[2]	mm (in)	25 (1.0)	33 (1.3)
• Minimum Rib Thickness[2]	mm (in)	1.27 (0.05)	1.27 (0.05)
• Tensile Strength @ 2% Strain[3]	kN/m (lb/ft)	6.0 (410)	9.0 (620)
• Tensile Strength @ 5% Strain[3]	kN/m (lb/ft)	11.8 (810)	19.6 (1,340)
• Ultimate Tensile Strength[3]	kN/m (lb/ft)	19.2 (1,310)	28.8 (1,970)
Structural Integrity			
• Junction Efficiency[4]	%	93	
• Flexural Stiffness[5]	mg-cm	750,000	
• Aperture Stability[6]	kg-cm/deg	6.5	
Durability			
• Resistance to Installation Damage[7]	%SC / %SW / %GP	95 / 93 / 90	
• Resistance to Long Term Degradation[8]	%	100	
• Resistance to UV Degradation[9]	%	100	

Dimensions and Delivery

The biaxial geogrid shall be delivered to the jobsite in roll form with each roll individually identified and nominally measuring 3.0 meters (9.8 feet) or 4.0 meters (13.1 feet) in width and 50.0 meters (164 feet) in length. A typical truckload quantity is 160 to 210 rolls.

Notes

1. Unless indicated otherwise, values shown are minimum average roll values (MARV) determined in accordance with ASTM D4759. The column labeled MD Values represents results from testing the product in the Machine Direction. The column labeled XMD Values represents results from testing the product in the Cross-Machine (Transverse) Direction.
2. Nominal dimensions.
3. True resistance to elongation when initially subjected to a load determined in accordance with ASTM D6637 without deforming test materials under load before measuring such resistance or employing "secant" or "offset" tangent methods of measurement so as to overstate tensile properties.
4. Load transfer capability determined in accordance with GRI-GG2-87 and expressed as a percentage of ultimate tensile strength.
5. Resistance to bending force determined in accordance with ASTM D5732-95, using specimens of width two ribs wide, with transverse ribs cut flush with exterior edges of longitudinal ribs (as a "ladder"), and of length sufficiently long to enable measurement of the overhang dimension.. The overall Flexural Stiffness is calculated as the square root of the product of MD and XMD Flexural Stiffness values.
6. Resistance to in-plane rotational movement measured by applying a 20 kg-cm moment to the central junction of a 9 inch x 9 inch specimen restrained at its perimeter in accordance with U.S. Army Corps of Engineers Methodology for measurement of Torsional Rigidity.
7. Resistance to loss of load capacity or structural integrity when subjected to mechanical installation stress in clayey sand (SC), well graded sand (SW), and crushed stone classified as poorly graded gravel (GP). The geogrid shall be sampled in accordance with ASTM D5818 and load capacity shall be determined in accordance with ASTM D6637.
8. Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments in accordance with EPA 9090 immersion testing.
9. Resistance to loss of load capacity or structural integrity when subjected to 500 hours of ultraviolet light and aggressive weathering in accordance with ASTM D4355.

Tensar Earth Technologies, Inc. warrants that at the time of delivery the geogrid furnished hereunder shall be of the quality and specification stated herein. If the geogrid does not meet the specifications on this page and Tensar is notified prior to installation, Tensar will replace the geogrid at no cost to the customer.

This product specification supersedes all prior specifications for the product described above and is not applicable to any products shipped prior to March 1, 2005

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	005
JOB NUMBER	T0113090	PAGE	OF
LOCATION	RFETS	RFI DATE	5-24-05
		REPLY DATE	5-25-05

TO	RANDY THOMPSON	COMPANY	~~PETRA~~ EARTH-TECH
SUBJECT	BUTTRESS	LOCATION	ROCKY FLATS - OLF
DRAWING NO.	N/A	SPEC. NO.	1310

INFORAMTION REQUESTED:

CHANGE HORIZONTAL TOLERANCE TO ± 0.5 FEET ON BUTTRESS TOE

REPLY REQUIRED BY ~~5-25-04~~ 5-25-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE

5-24-05
DATE

POTENTIAL IMPACT NOTICE
- __ SCHEDULE
- X LABOR
- __ MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

THE REQUESTED TOLERANCE IS ACCEPTABLE. VERTICAL TOLERANCE REMAINS AT ± 0.2 FOOT.

RM J M Keating — DATE 5/24/05

DM FOR RANDY THOMPSON — DATE 5/24/05

CQAE J H. Rale — DATE 5/25/05

CDPHE REPRESENTATIVE NA — DATE

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REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	006
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	5-24-05
		REPLY DATE	5-25-05

TO	RANDY THOMPSON	COMPANY	EARTH TECH
SUBJECT	GEOTEXTILE	LOCATION	ROCKY FLATS - OLF
DRAWING NO.	51888-011	SPEC. NO.	N/A

INFORAMTION REQUESTED:

ANCHOR GEOTEXTILE BY USING BUTTRESS DRAIN ROCK

REPLY REQUIRED BY 5-25-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE   DATE 5-25-05

POTENTIAL IMPACT NOTICE

- __ SCHEDULE
- __ LABOR
- __ MATERIAL
- X NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION : SEE ATTACHED SKETCH.

THE INTENT OF THE NONWOVEN GEOTEXTILE IS TO PREVENT THE FINES FROM THE BUTTRESS FILL FROM CLOGGING THE VOIDS OF THE UNDERLYING DRAIN ROCK. IF THE DRAIN ROCK THICKNESS IS GREATER THAN 2 FEET, THE GEOTEXTILE MUST EXTEND 5 FEET FROM THE TOE OF THE DRAIN ROCK SLOPE SO IT EXTENDS UNDERNEATH THE TOE OF THE BUTTRESS FILL. IF THE DRAIN ROCK THICKNESS IS LESS THAN 2 FEET, IT IS ACCEPTABLE TO TUCK THE GEOTEXTILE A MAXIMUM OF ONE FOOT UNDERNEATH THE TOE OF THE DRAIN ROCK. DO NOT TUCK UNDER MORE THAN ONE FOOT TO PREVENT A BUILDUP OF SILT BEHIND THE GEOTEXTILE, WHICH WOULD OBSTRUCT DRAINAGE.

M Keating	5/24/05
RM	DATE
FOR RANDY THOMPSON	5/24/05
DM	DATE
J.H.	5/25/05
CQAE	DATE
NA	
CDPHE REPRESENTATIVE	DATE

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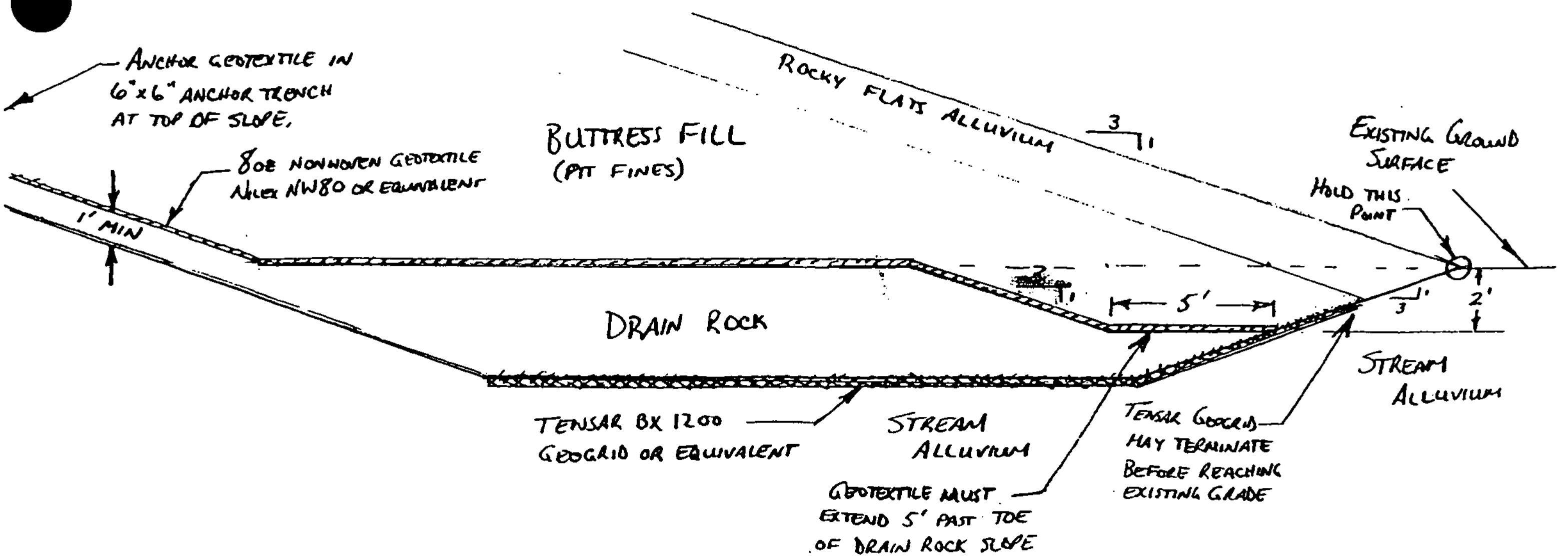
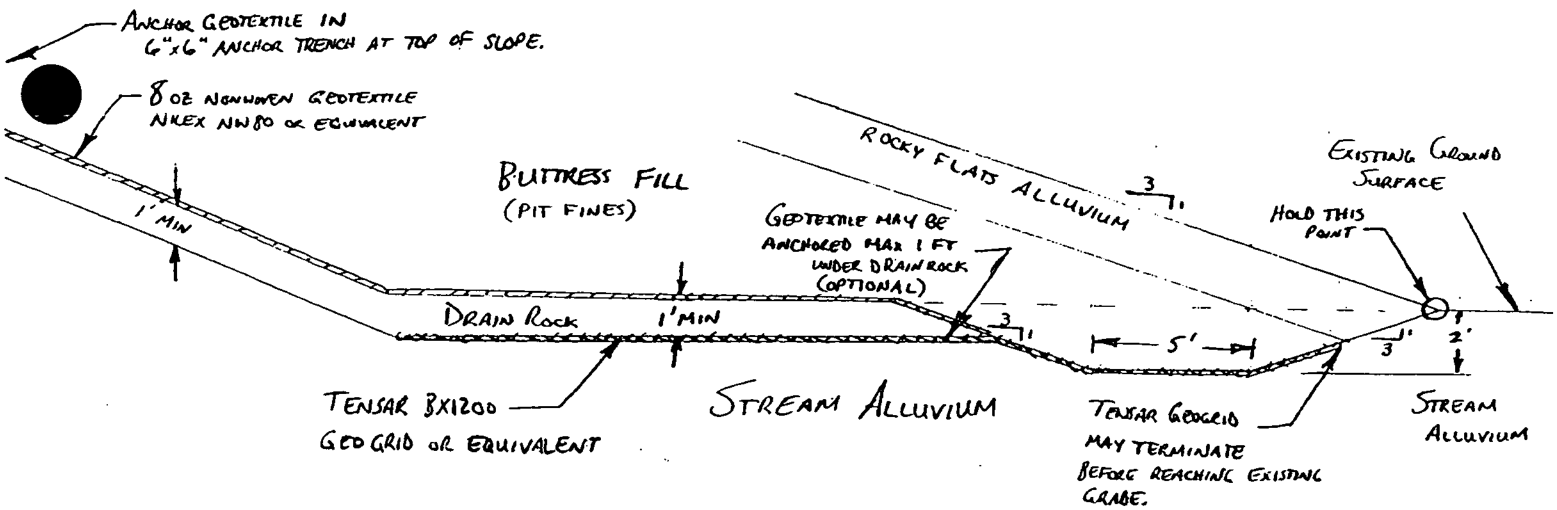
TWO SCENARIOS

1) SUBGRADE EXCAVATION GREATER THAN 2 FT:



2) SUBGRADE EXCAVATION LESS THAN 2 FT:



TYPICAL TOE OF BUTTRESS

NTS

SFP 5/24/05

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	007
JOB NUMBER	T0113090	PAGE	1 OF 2
LOCATION	RFETS	RFI DATE	5-27-05
		REPLY DATE	5-31-05

TO	RANDY THOMPSON	COMPANY	EARTH TECH, INC.
SUBJECT	REGRADE MATERIAL	LOCATION	Englewood, CO
DRAWING NO.	N/A	SPEC. NO.	02221-0983

INFORAMTION REQUESTED:

IS ATTACHED MATERIAL ACCEPTABLE FOR REGRADE MATERIAL. THIS MATERIAL IF FROM CENTENNIAL AGGREGATES. PIT NAME IS ECONOMY ROAD BASE

Randy: Note Atterberg Limits

REPLY REQUIRED BY 5-31-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE
- ✓ SCHEDULE
- __ LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

CONTRACTOR REP SIGNATURE [signature] DATE 5-27-05

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION:

The gradation for Economy Road Base from Centennial aggregates appears to be in line with previously-used aggregate. PI=21

Design Team has been informed by QC that the economy road base material will come from the production line, not an existing stockpile. Therefore, Specification Section 02200 testing frequencies are not applicable and 1 test is sufficient to characterize.

RM [signature] DATE 5/31/05

DM [signature] for Randy Thompson DATE 6/13/05

CQAE J.H. Rule DATE 6/15/05

CDPHE REPRESENTATIVE NA DATE

A test section is recommended similar to that done for Pioneer pit fines JHR

252

May-05

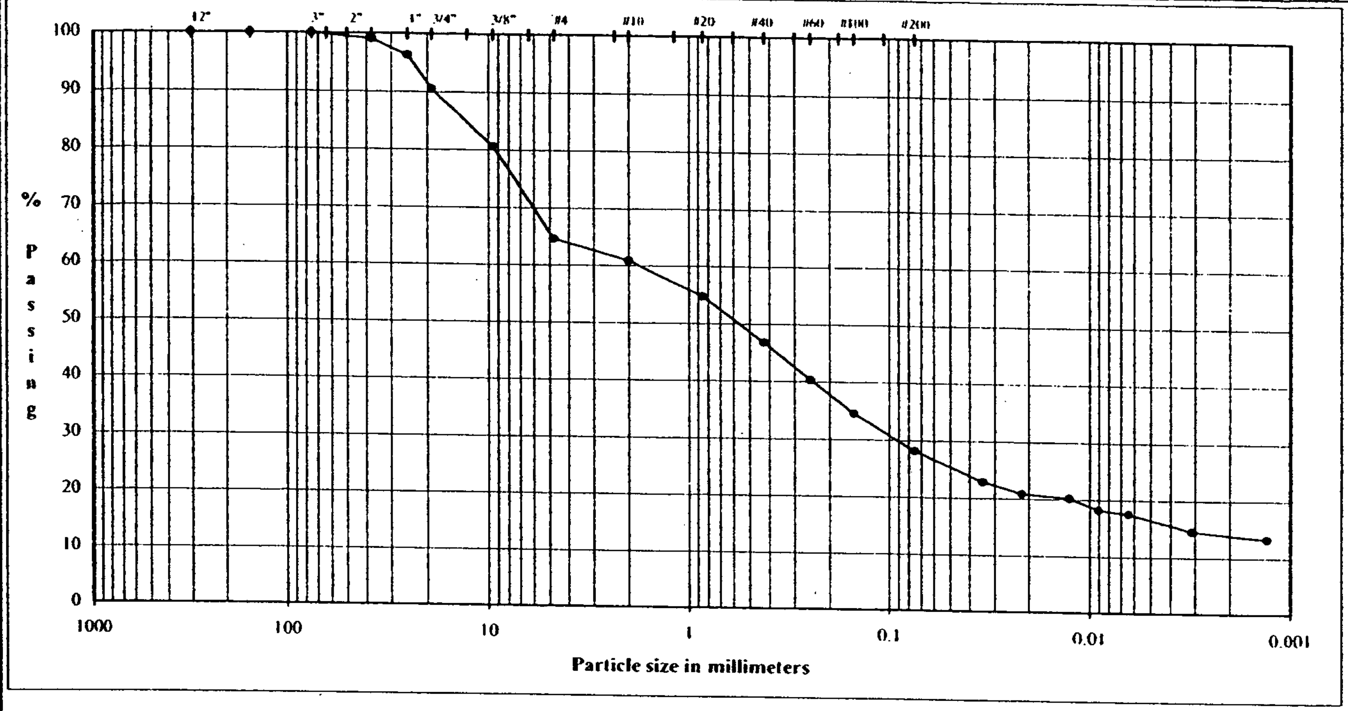
053-2203-0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: CERB-1
TYPE: Pail

Depth (ft): -



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

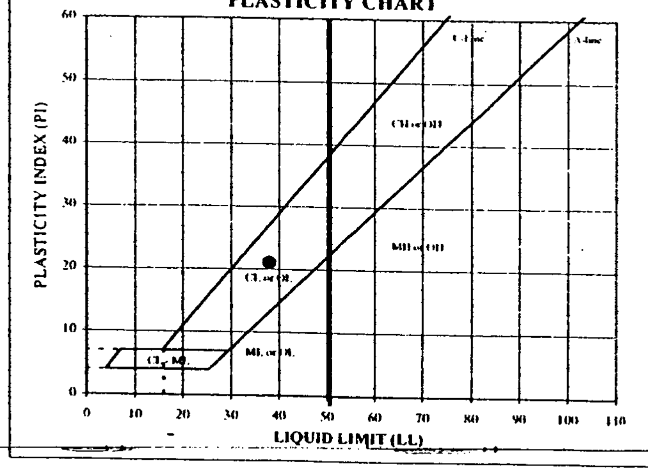
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
6.0"	154.2	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	99.1		
1.0"	25.0	96.3	Coarse Gravel	9.54
0.75"	19.0	90.5		
0.375"	9.5	80.6		
#4	4.8	64.5	Fine Gravel	25.93
#10	2.00	60.8	Coarse Sand	3.70
#20	0.85	54.7		
#40	0.43	46.7	Medium Sand	14.10
#60	0.25	40.3		
#100	0.15	34.5		
#200	0.075	28.1	Fine Sand	18.61

Hydrometer Analysis

(mm)	%Finer		
0.034	22.8		
0.022	20.8		
0.013	20.2	Fines	
0.0090	18.2	Silt or Clay	28.11
0.0064	17.5		
0.0031	14.6		
0.0013	13.2		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG (assumed)
–	38	17	21	2.70

DESCRIPTION: Reddish yellow clayey sand with gravel

USCS: SC

TECH	DS
DATE	5/12/2005
REVIEW	MB

Golder Associates Inc.

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	008
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	6-7-05
		REPLY DATE	6-8-05

TO	Scott Powell	COMPANY	Earth Tech
SUBJECT	Regrade & Cap Tie-in	LOCATION	Rocky Flats - OLF
DRAWING NO.	51788-006	SPEC. NO.	N/A

INFORAMTION REQUESTED:

Clarify Regrade & Cap in vicinity of active gas line

REPLY REQUIRED BY 6-8-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE

- __ SCHEDULE
- X LABOR
- __ MATERIAL
- __ NO IMPACT
- __ OTHER ______

CONTRACTOR REP SIGNATURE ______ DATE 6-7-05

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION:

The active natural gas line is outside the area of the engineered regrade surface contours. In this region, the intent is to tie the 18% slope of the top of regrade surface (SG-2) into existing ground. Because scarification at the surface in the vicinity of the gas line demonstrates that the top one foot of soil is clean, the in situ soil will serve as regrade fill material. No further soil disturbance within 10 horizontal feet of the gas line is necessary or recommended. For further clarification, an additional 8 control points are delineated on the attached drawing to provide existing grade control in the three small special-case areas where the limit of waste falls outside the engineered regrade surface contours.

Need to verify/certify edge of waste all outside gas line right of way to ensure future gas line exc. does not encounter waste. JHR

RM ______ DATE 6/7/05

DM ______ DATE 6/8/05

CQAE J.H. Rale DATE

CDPHE REPRESENTATIVE N/A DATE

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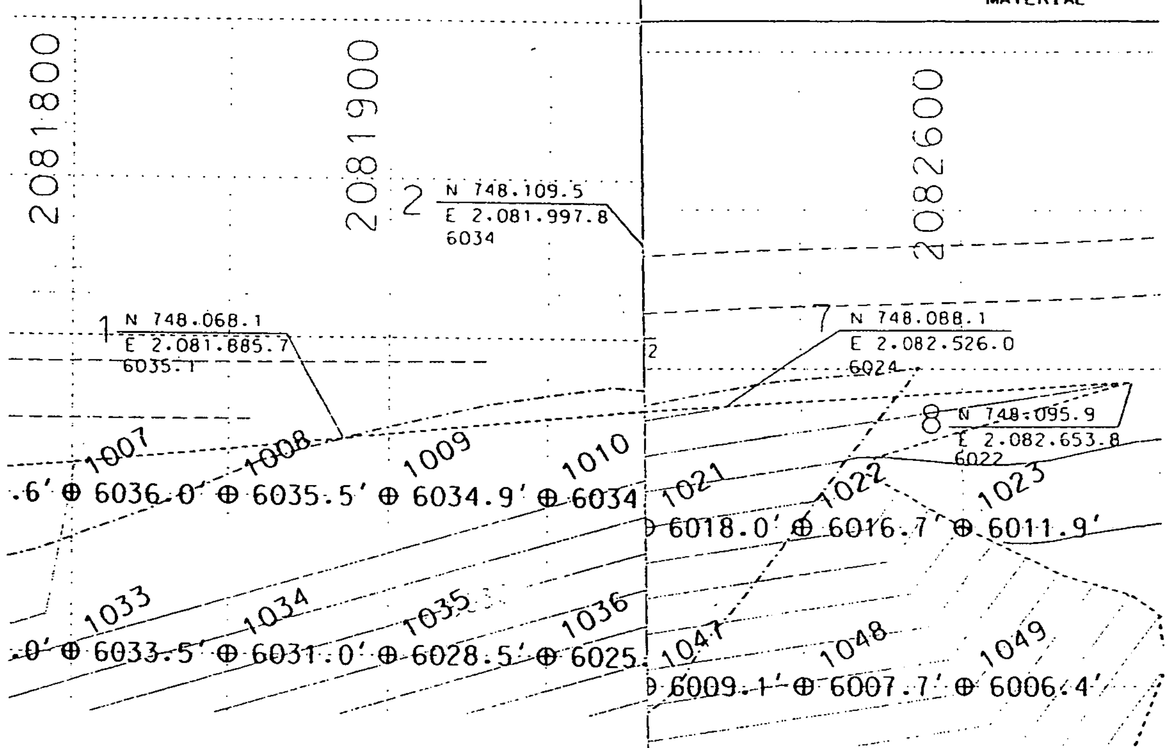
1	748068.1	2081885.7	6035.1	limit of cover
2	748109.5	2081997.8	6034.0	limit of cover
3	748086.6	2082091.1	6032.0	limit of cover
4	748056.3	2082101.8	6030.0	limit of cover
5	748076.8	2082308.8	6028.0	limit of cover
6	748081.4	2082412.2	6026.0	limit of cover
7	748088.1	2082526.0	6024.0	limit of cover
8	748095.9	2082653.8	6022.0	limit of cover

L:\group\CAD\ROCKY_FLATS\OLF_2005\CntrlPts\TopofRg006\new loc points.csv

255

MATERIAL



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REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	009
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	6-16-05
		REPLY DATE	6-16-05

TO	RANDY THOMPSON	COMPANY	EARTH TECH
SUBJECT	BUTTRESS BACKSLOPE	LOCATION	ROCKY FLATS OLF
DRAWING NO.	51788-003	SPEC. NO.	N/A

INFORAMTION REQUESTED:

DUE TO GRUBBING AND CONTOURING OF BUTTRESS BACKSLOPE THE CURRENT CONTROL POINTS ARE NOT ELEVATION DEPENDENT. NEED NEW TIE-IN POINTS BASED ON NEW SURFACE TO ENSURE BUTTRESS IS BUILT TO THE DESIGNED ~~[illegible]~~ hieght.

REPLY REQUIRED BY 6-16-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

[signature]
CONTRACTOR REP SIGNATURE

6-16-05
DATE

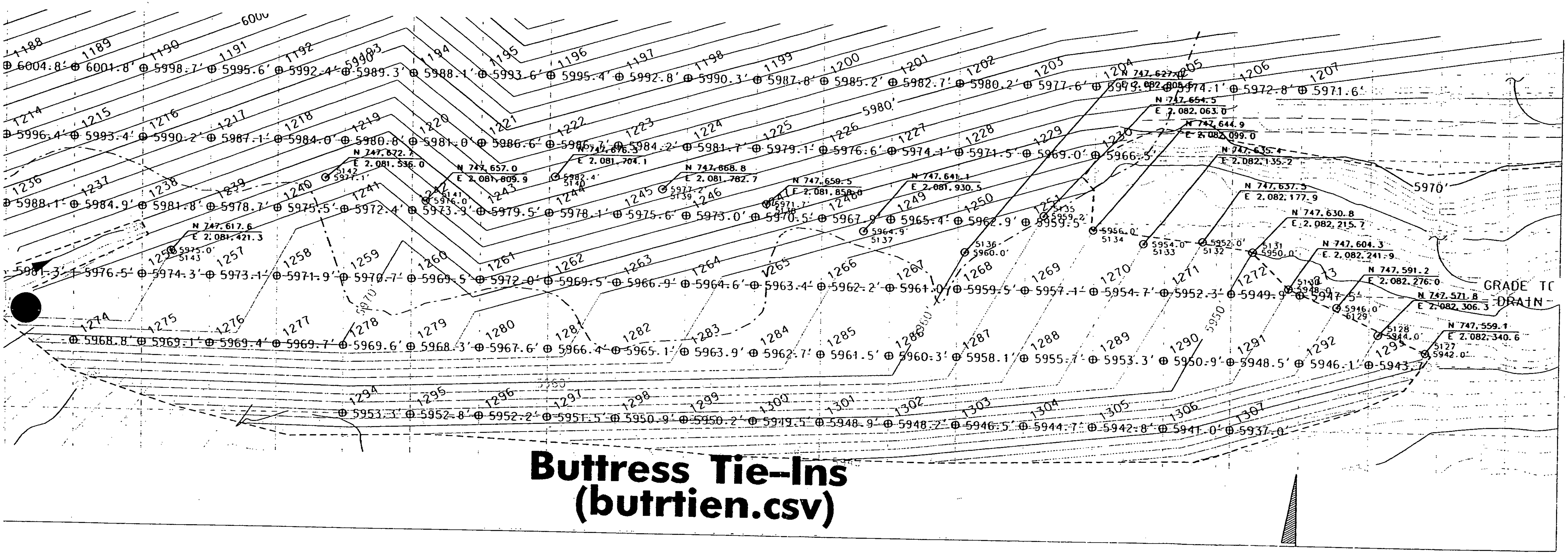
POTENTIAL IMPACT NOTICE
- X SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ____

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

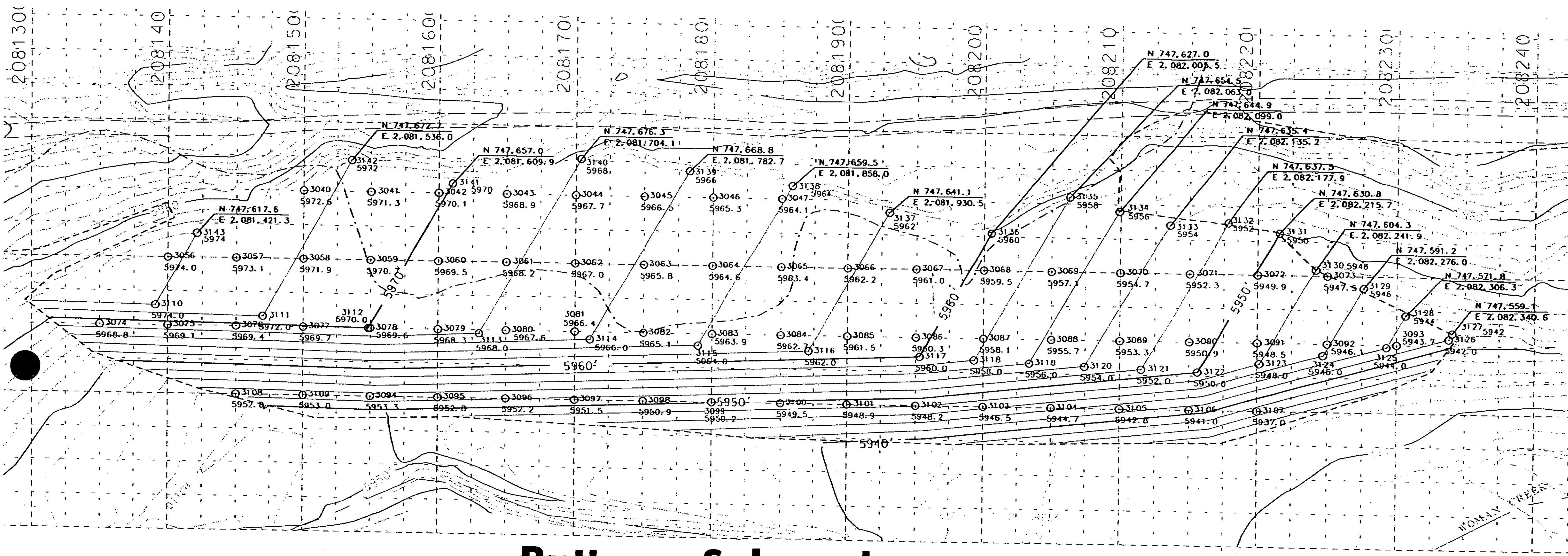
Please see attached control points to guide the construction of the buttress backslope tie-in. The first set of points (3127-3143) are the design locations and elevations of the tie-ins. The second set of points (5127-5143) are the same control point locations with elevations reflective of the regrade fill. Please provide the Design Team with cut/fill information on these points once surveyed to determine if the intent of Design Drawing 011 will be met.

[signature] RM	6/20/05 DATE
[signature] DM	6/16/05 DATE
[signature] for John Rake AW QQAE	6/17/05 DATE
N/A CDPHE REPRESENTATIVE	DATE



Buttress Tie-Ins
(butrtien.csv)

258



Buttress Subgrade
(butrsub.csv)

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	010
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	7-6-05
		REPLY DATE	7-7-05

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT		LOCATION	OLF-Rocky Flats
DRAWING NO.		SPEC. NO.	N/A

INFORAMTION REQUESTED:

Change the grade back for depth of cap due to waste. Need new elevations/control points based on as built surveys from Flatirons Survey

REPLY REQUIRED BY 7-7-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

Steven [signature]
CONTRACTOR REP SIGNATURE

7-6-05
DATE

POTENTIAL IMPACT NOTICE
- X SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

See attached map and control points for the modified contours at the north end of the swale. These modified contours provide for a minimum of two feet of cover over the entire as-built regrade surface. Also provided are control points along all grade breaks of the final cover.

RM: JM Keating — DATE: 7/7/05

DM: [signature] for Randy Thompson — DATE: 7/12/05

CQAE: J.H. Earle — DATE: 7/13/05

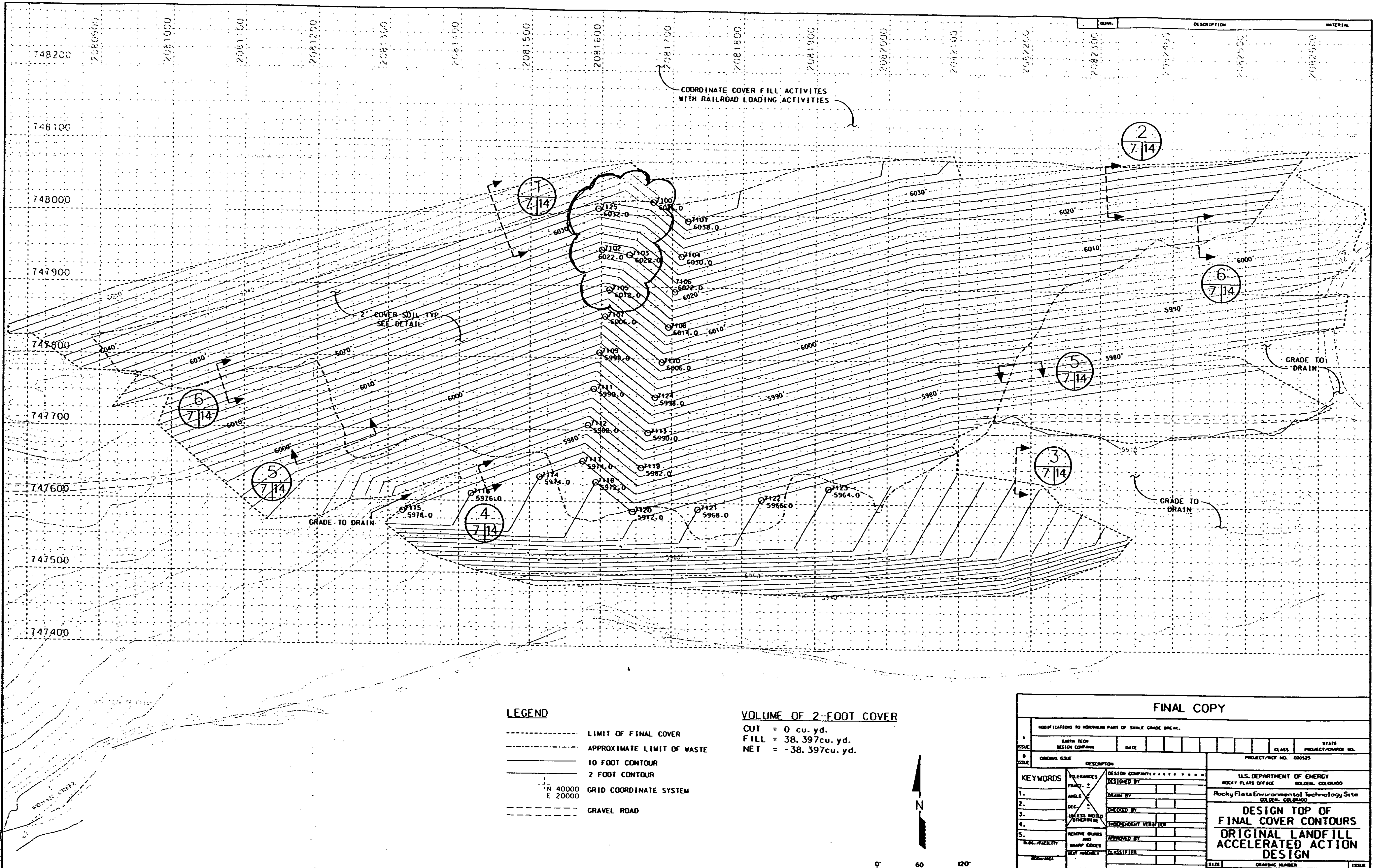
CDPHE REPRESENTATIVE: NA — DATE:

260

Rocky Flats Original Landfill 7/12/05
Modified Swell/Final Grade Elevations

Number	Northing	Easting	Elevation
7100	748017.9	2081672.1	6036
7101	747991.7	2081723.2	6038
7102	747950.8	2081601	6022
7103	747944.5	2081639.8	6022
7104	747942.7	2081713.7	6030
7105	747895.7	2081612	6012
7106	747893.6	2081704.2	6022
7107	747858	2081606.1	6006
7108	747844.5	2081694.7	6014
7109	747807.7	2081598.1	5998
7110	747795.5	2081685.2	6006
7111	747757.3	2081590.2	5990
7112	747707	2081582.3	5982
7113	747697.4	2081666.2	5990
7114	747634.3	2081513.9	5974
7115	747586	2081320.2	5978
7116	747610.2	2081417.1	5976
7117	747656.7	2081574.4	5974
7118	747627.8	2081593.2	5972
7119	747648.3	2081656.7	5982
7120	747587	2081644.9	5972
7121	747591.3	2081738.2	5968
7122	747605.7	2081826.8	5966
7123	747621.2	2081919	5964
7124	747746.4	2081675.7	5998
7125	748007.9	2081595.4	6032

261



LEGEND

- - - - - -	LIMIT OF FINAL COVER
- · - · - ·	APPROXIMATE LIMIT OF WASTE
———	10 FOOT CONTOUR
———	2 FOOT CONTOUR
N 40000 E 20000	GRID COORDINATE SYSTEM
— — — —	GRAVEL ROAD

VOLUME OF 2-FOOT COVER

CUT = 0 cu. yd.
FILL = 38,397cu. yd.
NET = -38,397cu. yd.

N

0' 60 120'

FINAL COPY

ISSUE	DESCRIPTION	
1	MODIFICATIONS TO NORTHERN PART OF SWALE GRADE BREAK. EARTH TECH DESIGN COMPANY	CLASS 51578 PROJECT/CHARGE NO.
0	ORIGINAL ISSUE	PROJECT/WCF NO. 020525

KEYWORDS 1. 2. 3. 4. 5.

TOLERANCES FRACT. ± ANGLE ± DEC. ± UNLESS NOTED OTHERWISE

REMOVE BURRS AND SHARP EDGES

DESIGNED BY / DRAWN BY / CHECKED BY / INDEPENDENT VERIFIER / APPROVED BY / CLASSIFIER

SCALE: AS SHOWN

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

DESIGN TOP OF FINAL COVER CONTOURS

ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE B DRAWING NUMBER 51788-007 ISSUE 1

GROUP\CAD\ROCKY_FLATS\Olf_2005\FinalGrds\FGGBcvr.dgn Date: 7-2005

262

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	011
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	7-20-05
		REPLY DATE	7-21-05

TO	RANDY THOMPSON	COMPANY	EARTH TECH
SUBJECT	WASTE TO SG-2 LEVEL	LOCATION	ROCKY FLATS
DRAWING NO.	51788-005	SPEC. NO.	N/A

INFORAMTION REQUESTED:

AREA ABOVE THE BUTTRESS ON SOUTH EAST BOUNDARY WASTE IS UP TO SG-2 ~~AR~~ ELEVATION VS. AT SG-1 ELEVATION FOR ~~THE~~ REMAINDER OF SITE

FOR INFORMATION ONLY

REPLY REQUIRED BY 7-21-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE

DATE 7-20-05

POTENTIAL IMPACT NOTICE

- X SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

Regrade surface at SG-2 elevation is acceptable and is consistent with the design

RM — DATE 7/20/05

DM — DATE 7/20/05

CQAE — DATE 7/20/05

CDPHE REPRESENTATIVE — DATE 7-20-05

263

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	012
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	7-20-05
		REPLY DATE	7-21-05

TO	RANDY THOMPSON	COMPANY	EARTH TECH
SUBJECT	DIVERSION BERM 3 DRAIN	LOCATION	ROCKY FLATS - OLF
DRAWING NO.	51788-009	SPEC. NO.	N/A

INFORAMTION REQUESTED:

ACCORDING TO DRAWING # ~~60~~ 51788-009 SHOWS THE WEST END OF DIVERSION BERM #3 GOING UP HILL. NEED NEW ALIGNMENT

REPLY REQUIRED BY 7-21-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE
- X SCHEDULE
- __ LABOR
- __ MATERIAL
- __ NO IMPACT
- __ OTHER ________

[signature]
CONTRACTOR REP SIGNATURE

7-20-05
DATE

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

Horizontal control and vertical elevations were given for the west end of Diversion Berm #3 that will result in a continuous slope of 2% all the way into the west perimeter channel (sent via e-mail on 7/8/05)

However, in these grade-to-drain areas specified in the design, the Contractor may field fit the alignment of the diversion berm(s) as long as the drainage slope is maintained between 1 and 3%.

[signature] M Keating
RM

7/20/05
DATE

[signature]
DM

7/20/05
DATE

J.H. Rela
CQAE

7/20/05
DATE

N/A
CDPHE REPRESENTATIVE

DATE

264

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	013
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	7-25-05
		REPLY DATE	7-26-05

TO	RANDY THOMPSON	COMPANY	EARTH-TECH
SUBJECT	DIVERSION BERMS + CHANNELS	LOCATION	ROCKY FLATS
DRAWING NO.	51788-012A	SPEC. NO.	N/A

INFORAMTION REQUESTED:

• REQUEST CHANGE DIVERSION BERM SOUTH FACE TO MINIMUM OF ~~3:1 SLOPE~~ ~~ON~~ 2:1 FOR EASY OF CONSTRUCTION.

• THE ENDS OF DIVERSION CHANNELS NEED TO BE GRADE TO DRAIN DUE TO DIFFERENCES IN ACTUAL ELEVATIONS COMPARED TO DRAWING ELEVATION

REPLY REQUIRED BY 7-26-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE
- __ SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

[signature] 7-25-05

CONTRACTOR REP SIGNATURE DATE

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

• Diversion berm backslopes (South faces) may be shallower than 2:1 for ease of construction. Slope may not be any steeper than 2:1.

• The perimeter channel outlets on the south end must grade to drain into Woman Creek. If elevation control points conflict with existing ground in meeting this intent, then grade to drain and conduct an as-built survey for record.

JM Keating	7/25/05
RM	DATE
[signature]	7/25/05
DM	DATE
J.H. [signature]	7/27/05
CQAE	DATE
N/A	
CDPHE REPRESENTATIVE	DATE

265

REQUEST FOR INFORMATION

PROJECT	**Cover Original Landfill**	RFI NO.	015
JOB NUMBER	**T0113090**	PAGE	OF
LOCATION	**RFETS**	RFI DATE	7-28-05
		REPLY DATE	7-29-05

TO	RANDY THOMPSON	COMPANY	EARTH TECH
SUBJECT	EROSION MAT STAKES/STAPLES	LOCATION	ROCKY FLATS - OLF
DRAWING NO.	N/A	SPEC. NO.	02227

INFORAMTION REQUESTED:

WOULD LIKE TO USE 60 PENNY SPIKES WITH WASHERS VERSUS THE 6 INCH STAPLES. SEE ATTACHED LETTER FROM MANUFACTURE.

REPLY REQUIRED BY 7-29-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE

DATE 7-28-05

POTENTIAL IMPACT NOTICE

- __ SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

Based on the attached letter from the manufacturer BioSTAKE and EcoSTAKES are acceptable due to the 2-3 year degradation. In addition, the 60 penny spikes are also acceptable as these are more suitable to the Rocky Flats Alluvium rocky soils. However, please discuss w/ Ecology Dept. If these 6" spikes pull-up in the future, the will have to be replaced with longer spikes. This will be inspected during the monitoring/maintenance period.

RM — DATE 8/3/05

FOR RANDY THOMPSON

DM — DATE 7/29/05

CQAE — DATE 8/3/05

N/A

CDPHE REPRESENTATIVE — DATE

2660

July 28, 2005

) Jeremy Jaramillo
nvirocon

Hello Jeremy,

Thank you for your interest in North American Green. It is my understanding that, because of the rocky soil at Rocky Flats, there has been some difficulty installing North American Green's C125BN using the standard "U" shaped wire staples. It is understandable that these staples may bend when driven into very hard or rocky soil, which is one reason there are other fasteners available for holding erosion control blankets to the soil surface.

For instance, North American Green offers a biodegradable plastic stake, called the "BioSTAKE", that is available in 4 inch and 6 inch lengths. The BioSTAKE features a single-leg "T" shape that allows it to driven into rocky soils with greater success. Despite being plastic, BioSTAKEs are very rigid and will degrade in 2-3 years. Also offered by North American Green are single-leg, hardwood stakes called "EcoSTAKEs" available in 6 inch and 12 inch lengths.

It is incidental which fastener is used to secure C125BN to the soil surface as long as it is securely fastened. I would recommend obtaining samples of both the EcoSTAKE and BioSTAKE from Nilex Corp in Centennial, CO, try them both on the job site and use whichever fastener performs best with the given soil conditions

Please do not hesitate to contact me at 800-772-2040 is if you have any questions.

k you,

Todd Croke
Assistant Manager of Technical Services
North American Green, Inc.

cc: Mick Pyle

14649 Highway 41 North • Evansville, Indiana 47725 • 812-867-6632
800-772-2040 • FAX 812-867-0247 • www.nagreen.com

207

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	16
JOB NUMBER	T0113090	PAGE	1 OF 2
LOCATION	RFETS	RFI DATE	8-3-05
		REPLY DATE	8-4-05

TO	RANDY THOMPSON	COMPANY	EARTH TECH
SUBJECT	DIVERSION CHANNEL ANCHOR	LOCATION	OLF - ROCKY FLATS
DRAWING NO.	N/A	SPEC. NO.	02227-0986

INFORAMTION REQUESTED:

SECTION 3.01, A, 1 REQUIRES ANCHOR TO BE 10 FEET FROM TOP OF CHANNEL. REQUEST THIS BE CHANGED SO THAT ANY PLACE/DISTANCE AS LONG AS IT IS ABOVE THE FLOW LINE OF CHANNEL. THE NAG FOR CHANNEL INSTALL IS ATTACHED

REPLY REQUIRED BY 8-4-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE [signature] DATE 8-3-05

POTENTIAL IMPACT NOTICE

- __ SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION :

- In concurrence with the manufacturer's recommendation the anchor trench may be dug less than 10' back from the top of the channel, but not less than 1' back.
- NAG P550 must be installed below the flow line of the channel. If NAG P550 erosion matting is installed in the entire channel, it must be anchored in a trench set back from the top of the channel not less than 1'. Otherwise, the NAG P550 must be installed in an anchor trench above the flow line and NAG SC 125 BN may be used to cover the remaining sideslopes and must be anchored in a trench 1 foot back from the top of channel. Staple NAG P550 with staple pattern E.

RM JM Keating DATE 8/3/05

DM [signature] for RANDY THOMPSON DATE 8/3/05

CQAE [signature] for John Rahe DATE 8/3/05

CDPHE REPRESENTATIVE N/A DATE

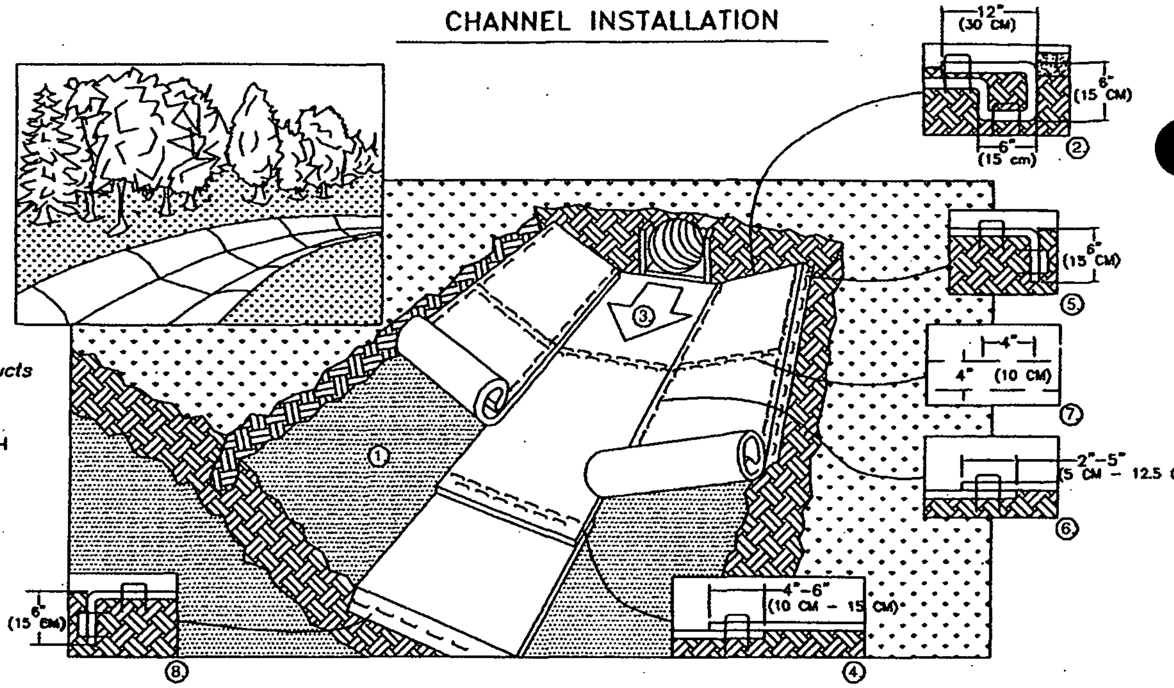
268

CHANNEL INSTALLATION

NORTH AMERICAN GREEN

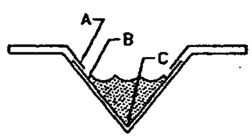
EROSION CONTROL *Products*
Guaranteed SOLUTIONS

14649 HIGHWAY 41 NORTH
EVANSVILLE, IN 47725
800-772-2040
www.nagreen.com



1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE CHANNEL BY ANCHORING THE RECP's IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30 CM) OF RECP's EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP's WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMAPCT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) ACROSS THE WIDTH OF THE RECP's.
3. ROLL CENTER RECP's IN DIRECTION OF WATER FLOW IN BOTTOM OF CHANNEL. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP's MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM™, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. PLACE CONSECUTIVE RECP's END OVER END (SHINGLE STYLE) WITH A 4" - 6" (10 CM - 15 CM) OVERLAP. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER TO SECURE RECP's.
5. FULL LENGTH EDGE OF RECP's AT TOP OF SIDE SLOPES MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
6. ADJACENT RECP's MUST BE OVERLAPPED APPROXIMATELY 2" - 5" (5 CM -12.5 CM) (DEPENDING ON RECP's TYPE) AND STAPLED.
7. IN HIGH FLOW CHANNEL APPLICATIONS, A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FOOT (9 M - 12 M) INTERVALS. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER OVER ENTIRE WIDTH OF THE CHANNEL.
8. THE TERMINAL END OF THE RECP's MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.

NOTE:
• IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY ANCHOR THE RECP's.



CRITICAL POINTS
A. OVERLAPS AND SEAMS
B. PROJECTED WATER LINE
C. CHANNEL BOTTOM/SIDE SLOPE VERTICES

NOTE:
• HORIZONTAL STAPLE SPACING SHOULD BE ALTERED IF NECESSARY TO ALLOW STAPLES TO SECURE THE CRITICAL POINTS ALONG THE CHANNEL SURFACE.

•• IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 cm) MAY BE NECESSARY TO PROPERLY ANCHOR THE RECP's.

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	~~ECR~~ RFI NO.	17
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	~~ECR~~ RFI DATE	8/18/2005
		REPLY DATE	8/19/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Erosion control on 3:1 buttress slope	LOCATION	Rocky Flats OLF
DRAWING NO.	51788-011	SPEC. NO.	02900 - Seeding

CHANGE REQUESTED

C125 erosion mat will be placed on the 3:1 slope of the buttress above the C350 erosion mat.
The steep slope may create safety issues with the crimping equipment.
The C125 will be placed according to manufactures instruction.

REPLY REQUIRED BY 8/19/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE
- __ SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- X OTHER

CONTRACTOR REP SIGNATURE — DATE 8/22/05

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

This is consistent with the original design and is approved.

RM M Keating — DATE 8/22/05

DM — DATE 8/18/05

CQAE for John Rake — DATE 8/22/05

NA

269

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	18
JOB NUMBER	T0113090	PAGE	1 OF
LOCATION	RFETS	RFI DATE	8-18-05
		REPLY DATE	

TO	RANDY THOMPSON	COMPANY	EARTH - TECH
SUBJECT	2-FOOT COVER	LOCATION	ROCKY FLATS - OLF
DRAWING NO.	006	SPEC. NO.	

INFORAMTION REQUESTED:

In order to maintain a two foot cover of buttress fill material over the drain rock control point 1251 must have a higher elevation on the east end of the buttress.

REPLY REQUIRED BY 8-22-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE

8-22-05
DATE

POTENTIAL IMPACT NOTICE
- __ SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ____________

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION:

Based on the elevation of drain rock at this control point, a revised top-of-regrade elevation of 5961.3 ft will provide 2 feet of buttress fill over the drain rock. As such, the top-of-final-cover elevation must be 5963.3 ft or 2 feet greater than the regrade elevation whichever is greater. Based on the regrade contours of Drawing 006, this revised elevation is consistent with the landfill and buttress design slopes.

RM — 9/06/05 DATE

DM — 9/1/05 DATE

for John Rahe
CQAE — 9/1/05 DATE

N/A
CDPHE REPRESENTATIVE — DATE

270

REQUEST FOR INFORMATION

PROJECT	Cover Original Landfill	RFI NO.	19
JOB NUMBER	T0113090	PAGE	OF
LOCATION	RFETS	RFI DATE	8-30-05
		REPLY DATE	8-31-05

TO	RANDY THOMPSON	COMPANY	EARTH - TECH
SUBJECT	C125 EROSION MAT	LOCATION	OLF - ROCKY FLATS
DRAWING NO.	N/A	SPEC. NO.	2221

INFORAMTION REQUESTED: WILL C125 MEET THE Technical EQUIVILENT OF C125BN?

C125BN is not currently available.

REPLY REQUIRED BY 8-31-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE

- X SCHEDULE
- __ LABOR
- __ MATERIAL
- __ NO IMPACT
- __ OTHER ______

[signature] 8-30-05

CONTRACTOR REP SIGNATURE DATE

INFORMATION TO CONTRACTOR

REQUESTED INFORMATION: C125 is equivalent to C125BN (with the exception of the degredation) and was originally specified in the Design. The ~~mat~~ erosion mat was changed to C125BN at the request of ~~RFETS Ecology~~ Fish & Wildlife. The Designer accepts the use of C125 so long as it is acceptable to ~~RFETS Ecology~~ Fish & Wildlife

J M Keating 8/30/05

RM DATE

[signature] For RANDY THOMPSON 8/30/05

DM DATE

[signature] For John Rahe 8/30/05

CQAE DATE

NA

CDPHE REPRESENTATIVE DATE

271

Keating, Michael

From: Thornburg, Amy
Sent: Thursday, September 01, 2005 11:43 AM
To: Keating, Michael
Subject: RE: Repair burnt erosion mat

The recent prescribed burns on the OLF must have been beneficial. There is a lot of native grass that has started growing in the two weeks since I have walked around out there. It looks like a really good initial response.

Amy Thornburg
Refuge Operations Specialist
(303) 966-5777
amy_thornburg@fws.gov
amy.thornburg@rf.doe.gov

-----Original Message-----
From: Keating, Michael
Sent: Tuesday, August 30, 2005 4:38 PM
To: Thornburg, Amy; Birk, Bob; Spreng, Carl
Cc: McQueary, Steven; Randy.Thompson@earthtech.com
Subject: Repair burnt erosion mat

All,
Currently there is no C125BN available to repair berm #5 that was destroyed in the fire last Friday. I have ordered C125 as a replacement and it is currently being installed. I have initiated an ECR to document the change.

Mike Keating, P.E.
RFETS Project Manager
Michael.Keating@RFETS.gov
Cell:303.994.0691

272

APPENDIX E-2: ENGINEERING CHANGE REQUESTS

274

ECR'S REGISTER

PROJECT Cover Original Landfill
JOB NUMBER T0113090
LOCATION RFETS

PAGE 1 of
DATE 5-17-05

Section Description	Section No.	Para. No.	Component	Description of Item	Transmittal No.	Submittal Classification[1]	Submission Date	Approval Date	Remarks
REGRADE FILL	N/A	N/A		PIT FINES FOR REGRADE	001	D	5/17/2005	5-19-05	
BUTTRESS	N/A	N/A		CHANGE BACKSLOPE OF BUTTRESS	002	D	5/18/2005	6-1-05	
BUTTRESS	3.06	9		CHANGE TESTING REQUIREMENTS	003	D	5-24-05	~~6-1-05~~ ~~5-31-05~~	CANCELLED 7-13-05
~~DRAWINGS 51788-006~~				~~LIMIT OF WASTE / GAS LINE~~	~~004~~	~~D~~			~~CANCELLED~~
DRAWING 51788-011	~~2.01~~			MINIMUM DEPTH OF DRAIN ROCK	005	D	6-9-05	6-15-05	
DRAIN ROCK	2.01	A		DRAIN ROCK SIEVE/PERM TESTS	007 ~~006~~	D	6-17-05	6-22-05	
QA/QC TABLE 7.1				DRAIN ROCK TESTING REQ.	006	D	6-14-05		
EROSION MATTING	2227			CHANGE C125 MAT TO FOXTEX	008	D	6-21-05	7-13-05	
GEOTEXTILE	2223			OUT OF SPEC. GEOTEXTILE	009	D	7-6-05	7-13-05	
GENERAL PROJECT	N/A	N/A	N/A	RE-ALIGN EAST ACCESS ROAD	010	D	7-7-05	7-20-05	
DRAWING # 51788-012A	N/A	N/A	N/A	HEIGHT OF DIVERSION BERM	011	D	7-26-~~05~~	9-6-05	
DRAWING 51788-011	N/A	N/A	N/A	SEEP UNDER DB # 3	012	D	8-11-05	9-6-05	
Drawing 51788-011	N/A	N/A	N/A	Seep south of DB # 3	013	D	9/7/05	9/12/05	

[1] Submittals shall be classified as D (Designer of Record Approval), QA (CQAE Approval), or FIO (For Information Only).

Ryan Archibald
Post-it® Fax Note 7671

To Randy Thompson	Date 5/17/05	# of pages ▸ 7
Co./Dept. Earth tech	From Mike Keating	
Phone #	Co. Kaiser Hill	
Fax # 303.694.4410	Phone #	
	Fax #	

ENGINEERING CHA
ECR #1

PROJECT	Cover Original Landfill	PAGE	
JOB NUMBER	T0113090	ECR DATE	5/17/2005
LOCATION	RFETS	REPLY DATE	5/18/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Regrade Fill	LOCATION	Rocky Flats OLF
DRAWING NO.	N/A	SPEC. NO.	02221-0983 Earthwork

CHANGE REQUESTED

Propose to use Pit Fines for regrade material. This will be used for site regrading only.
See attached testing data on material suggested for use and specifications for material.
Test Pad will be constructed as per specification 01110-0973 paragraph 1.01, 3 for review.

REPLY REQUIRED BY 5/18/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE DATE

POTENTIAL IMPACT NOTICE
__ SCHEDULE
__ LABOR
__ MATERIAL
__ NO IMPACT
__ OTHER ______

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

ased on the initial gradation testing (Particle Size and Atterberg limits) and compaction curve testing (Proctor) the Pioneer Quarry Pit Fines material appears iitable for regrade material use. However, since this represents a new material source, the stockpile that is available and proposed for use must be iaracterized in accordance with Specification Section 02200. Following EPA guidance referenced in Specification 02200 this requires one sample for each 500yd^3 of material used. If the only intended use is for regrade material, the previously run tests (those included in Specification 02200) of particle size)422), Atterberg limits (D4318) and compaction (D698) are appropriate.

RM M Keating DATE 5/19/05

DM DATE 5/18/05

CDAE DATE 5/19/05

CDPHE REPRESENTATIVE Carl Spreng DATE 5/19/05

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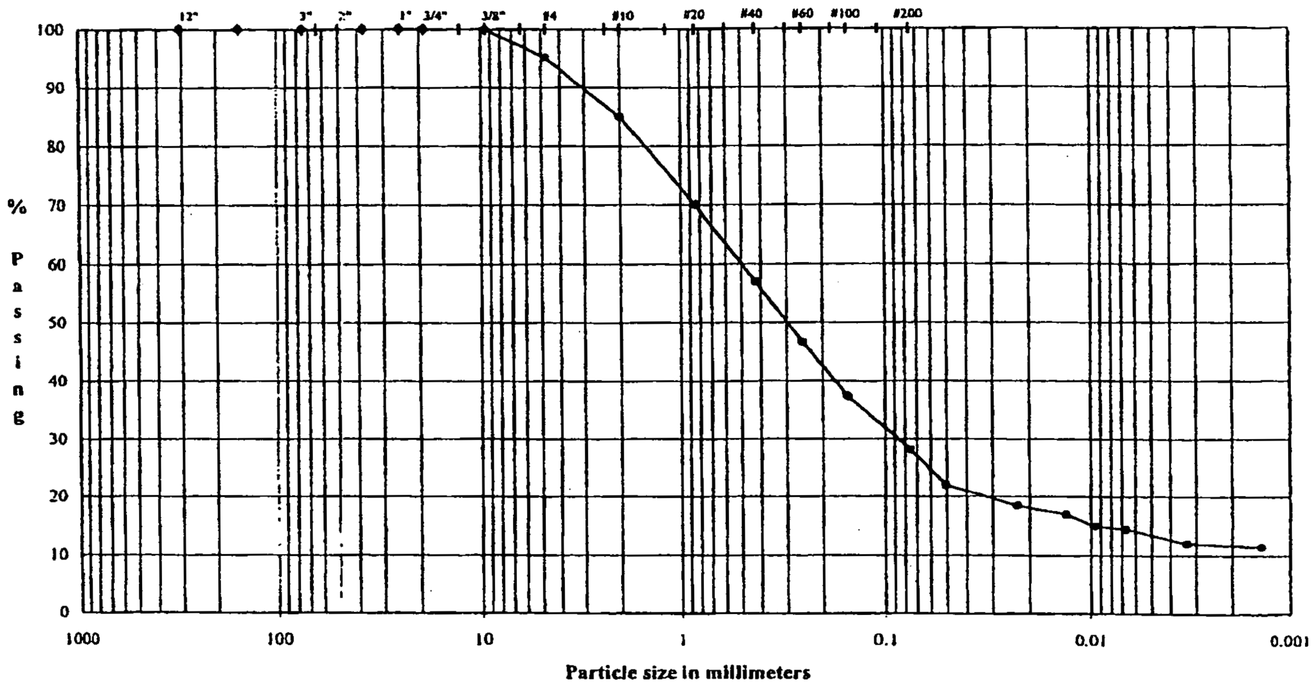
May-05 053-2203-0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: PSE-1 Depth (ft): -
TYPE: Pail



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

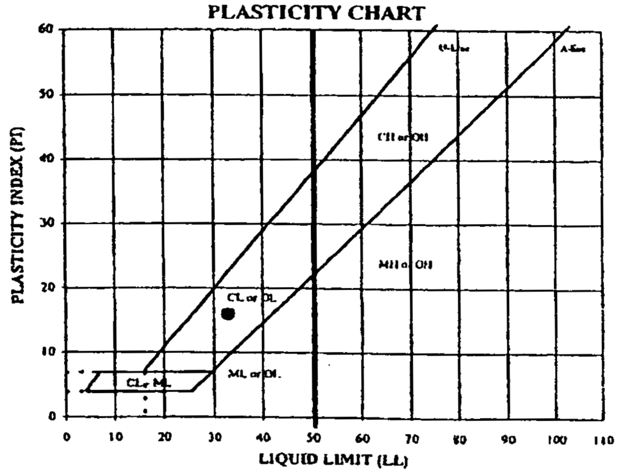
U.S. Standard Sieves Sizes and Numbers

Sieve	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	0.00
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Fine Gravel	4.91
0.375"	9.5	99.9		
#4	4.8	95.1		
#10	2.00	84.9	Coarse Sand	10.15
#20	0.85	70.1	Medium Sand	27.91
#40	0.43	57.0		
#60	0.25	46.6	Fine Sand	28.88
#100	0.15	37.3		
#200	0.075	28.2		

Hydrometer Analysis

(mm)	%Finer		
0.051	22.0	Fines Silt or Clay	28.16
0.023	18.5		
0.013	17.0		
0.0096	15.0		
0.0067	14.5		
0.0033	12.0		
0.0014	11.5		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	33	17	16	--

DESCRIPTION: Moderate yellowish brown clayey sand

USCS: SC

TECH	DT
DATE	5/10/2005
REVIEW	MB

Golder Associates Inc.

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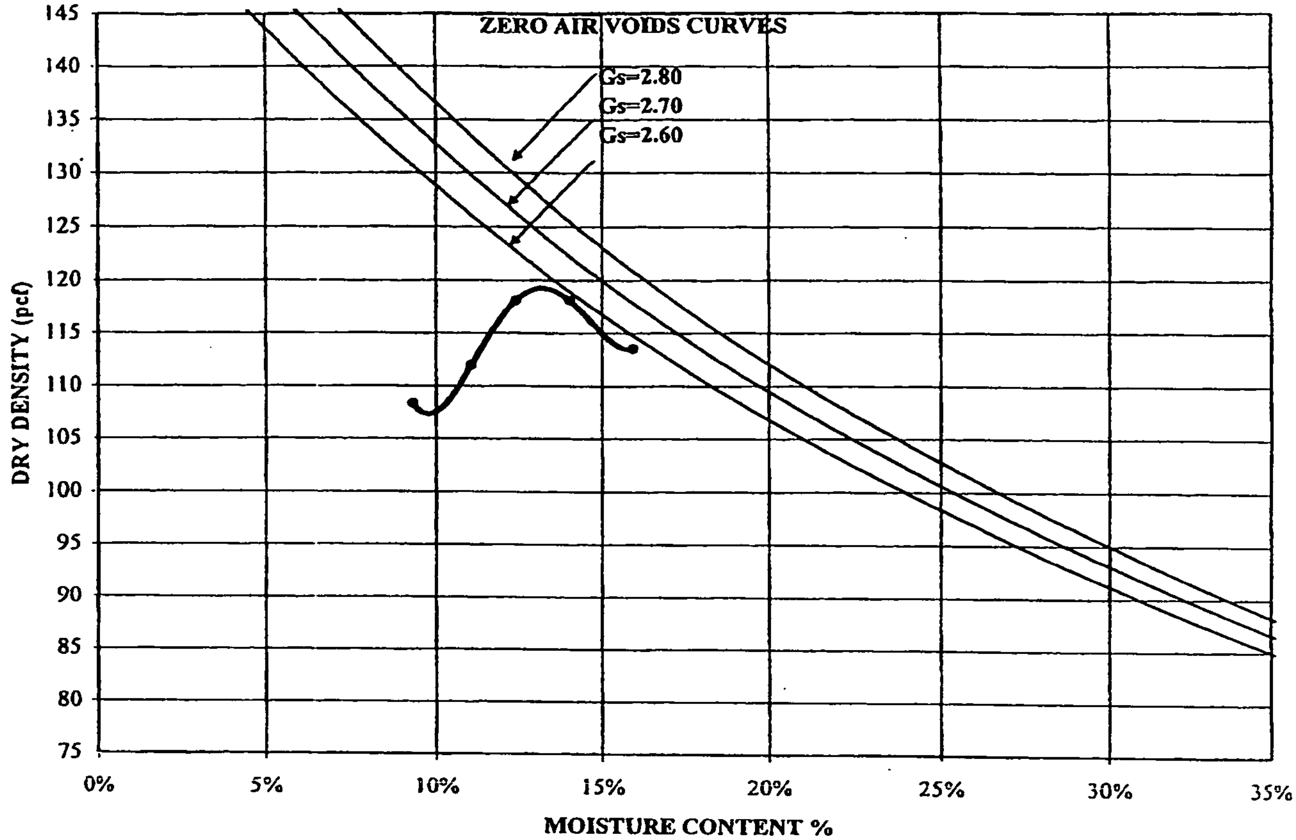
MOISTURE / DRY DENSITY CURVE
D 698 METHOD A

PSE-1



MAXIMUM DRY DENSITY (pcf)	119.0	
OPTIMUM MOISTURE (%)	13.2	NO CORRECTION REQUIRED

SAMPLE ID	PSE-1
SAMPLE TYPE	Pail
SAMPLE DEPTH	-

LL	33
PL	17
PI	16
MC	#DIV/0!

DESCRIPTION	Moderate yellowish brown clayey sand
USCS	SC

Kaiser Hill/Rocky Flats Field & Lab
053-2203-0001

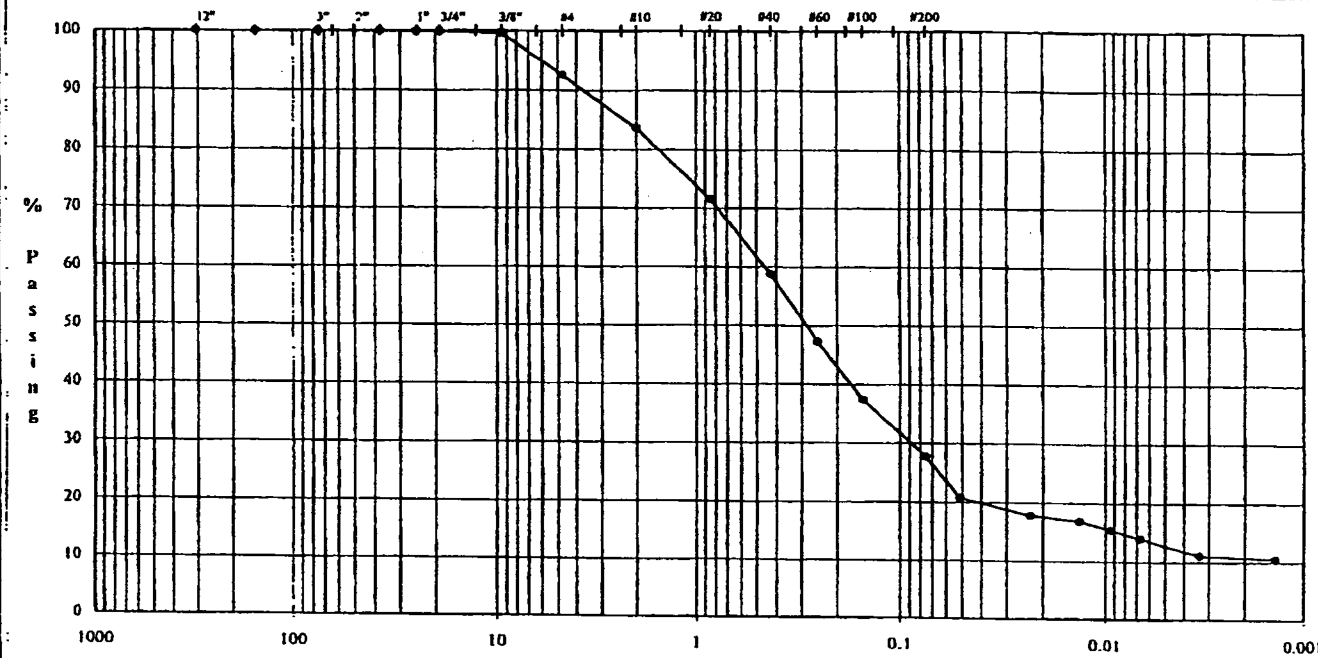
TECH	MKS
DATE	5-11-05
REVIEW	MB

May-05 053-2203-0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: PSW-1 Depth (ft): -
TYPE: Pail

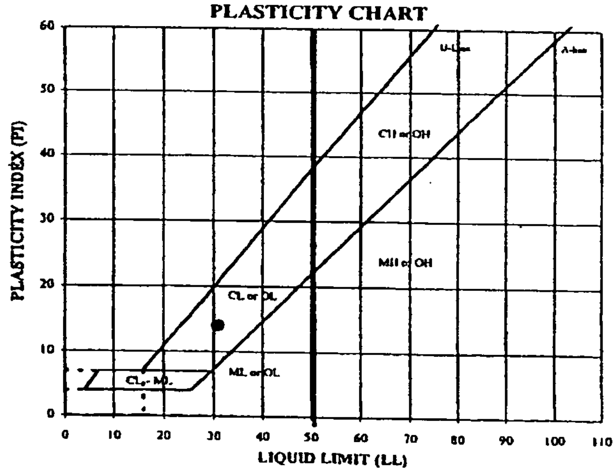


	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	0.13
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	99.9		
0.75"	19.0	99.9		
0.375"	9.5	99.6	Fine Gravel	7.36
#4	4.8	92.5		
#10	2.00	83.6	Coarse Sand	8.90
#20	0.85	71.6	Medium Sand	24.86
#40	0.43	58.7		
#60	0.25	47.3	Fine Sand	30.99
#100	0.15	37.3		
#200	0.075	27.8		

Hydrometer Analysis (mm)	%Finer	Particle Size Classification	Percentage
0.051	20.7	Fines Silt or Clay	27.76
0.023	17.8		
0.013	16.9		
0.0094	15.4		
0.0067	14.0		
0.0033	11.1		
0.0014	10.6		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
–	31	17	14	–

DESCRIPTION: Moderate yellowish brown

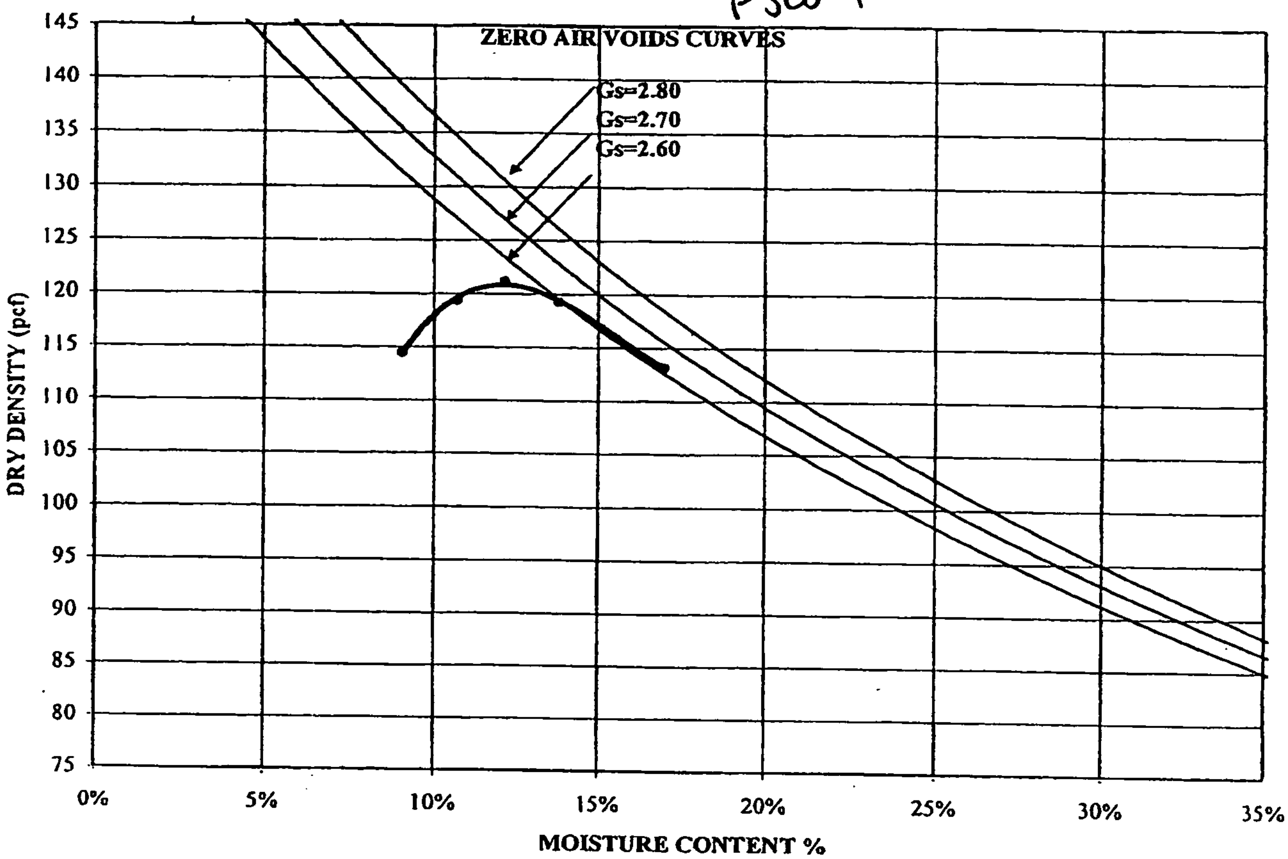
USCS: --

TECH	DT
DATE	5/10/2005
REVIEW	MB

Golder Associates Inc.

MOISTURE / DRY DENSITY CURVE
D 698 METHOD A

PSW-1



MAXIMUM DRY DENSITY (pcf)	121.2	Corrected Maximum Dry Density (pcf)	123.2
OPTIMUM MOISTURE (%)	12.1	Corrected Optimum Moisture (%)	11.5

SAMPLE ID	PSW-1
SAMPLE TYPE	Pail
SAMPLE DEPTH	-

LL	31
PL	17
PI	14
MC	#DIV/0!

DESCRIPTION: Moderate yellowish brown

USCS: –

Kaiser Hill/Rocky Flats Field & Lab
053-2203-0001

TECH	MKS
DATE	5-11-05
REVIEW	MB

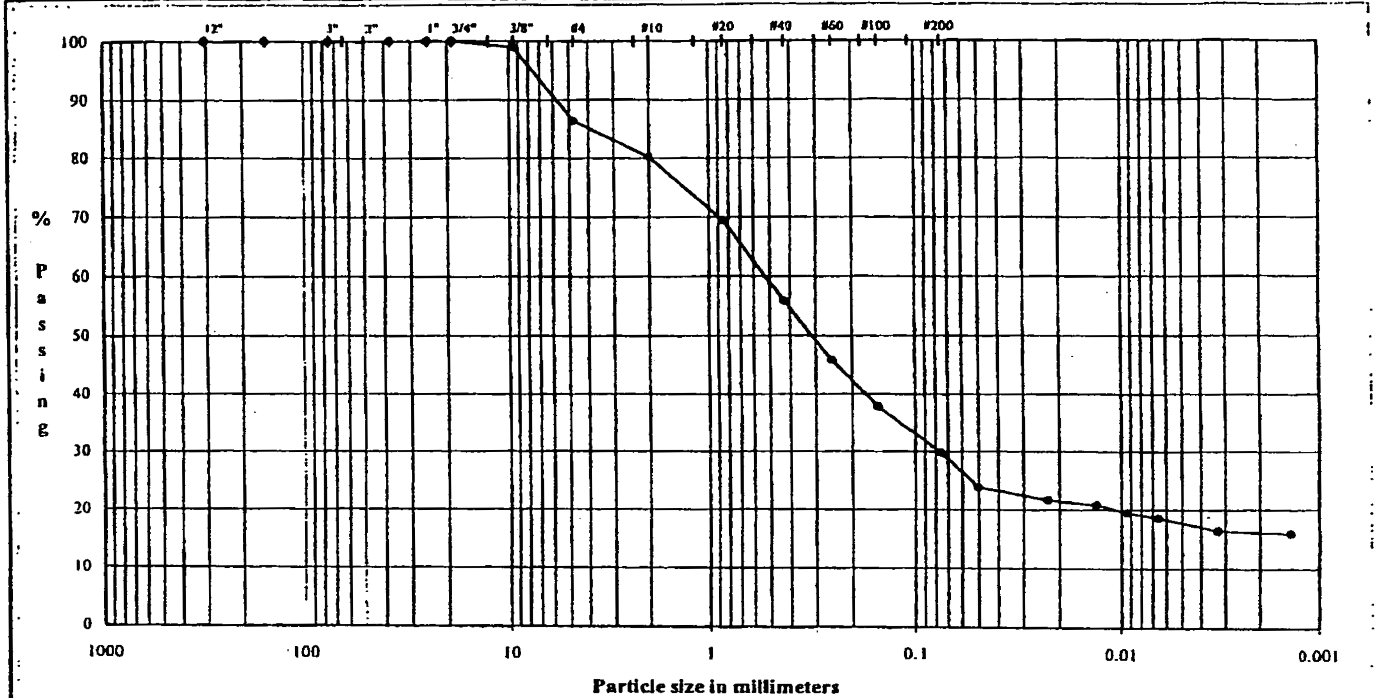
Golder Associates

May-05 053-2203-0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: CPF-1 Depth (ft): -
TYPE: Pail



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

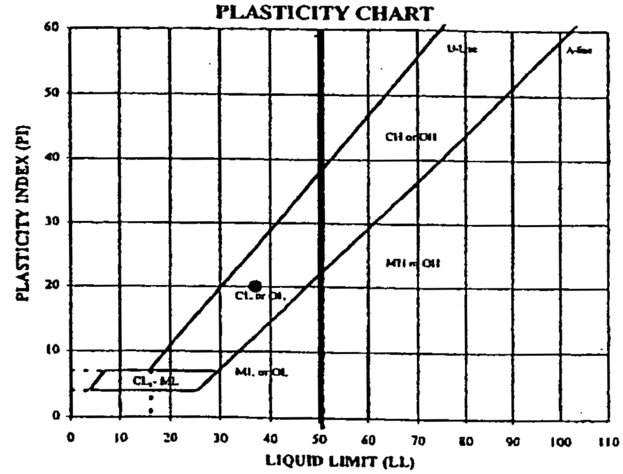
U.S. Standard Sieves Sizes and Numbers

		Sieve	Particle Size (mm)	% Passing	Particle Size Classification	Particle Size Percentage
		12.0"	304.8	100.0	Cobbles	0.00
		6.0"	154.2	100.0		
		6.0"	154.2	100.0		
		6.0"	154.2	100.0		
		3.0"	75.0	100.0		
		1.5"	37.5	100.0		
		1.0"	25.0	100.0	Coarse Gravel	0.00
	100	0.75"	19.0	100.0		
95	100	0.375"	9.5	99.0		
80	90	#4	4.8	86.4	Fine Gravel	13.63
65	80	#10	2.00	80.1	Coarse Sand	6.24
50	65	#20	0.85	69.4 7	>	
40	55	#40	0.43	55.8 7	Medium Sand	24.34
35	45	#60	0.25	45.7		
30	40	#100	0.15	37.8		
20	30	#200	0.075	29.8	Fine Sand	25.98

Hydrometer Analysis

(mm)	%Finer		
0.050	23.9	Fines Silt or Clay	29.81
0.023	21.7		
0.013	20.8		
0.0093	19.5		
0.0066	18.6		
0.0033	16.4		
0.0014	15.9		

PLASTICITY CHART



ATTERBERG LIMITS

M.	LL	PL	PI	SpG
–	37	17	20	–

DESCRIPTION: Moderate yellowish brown clayey sand

USCS: SC

TECH	DT
DATE	5/10/2005
REVIEW	MB

Golder Associates Inc.

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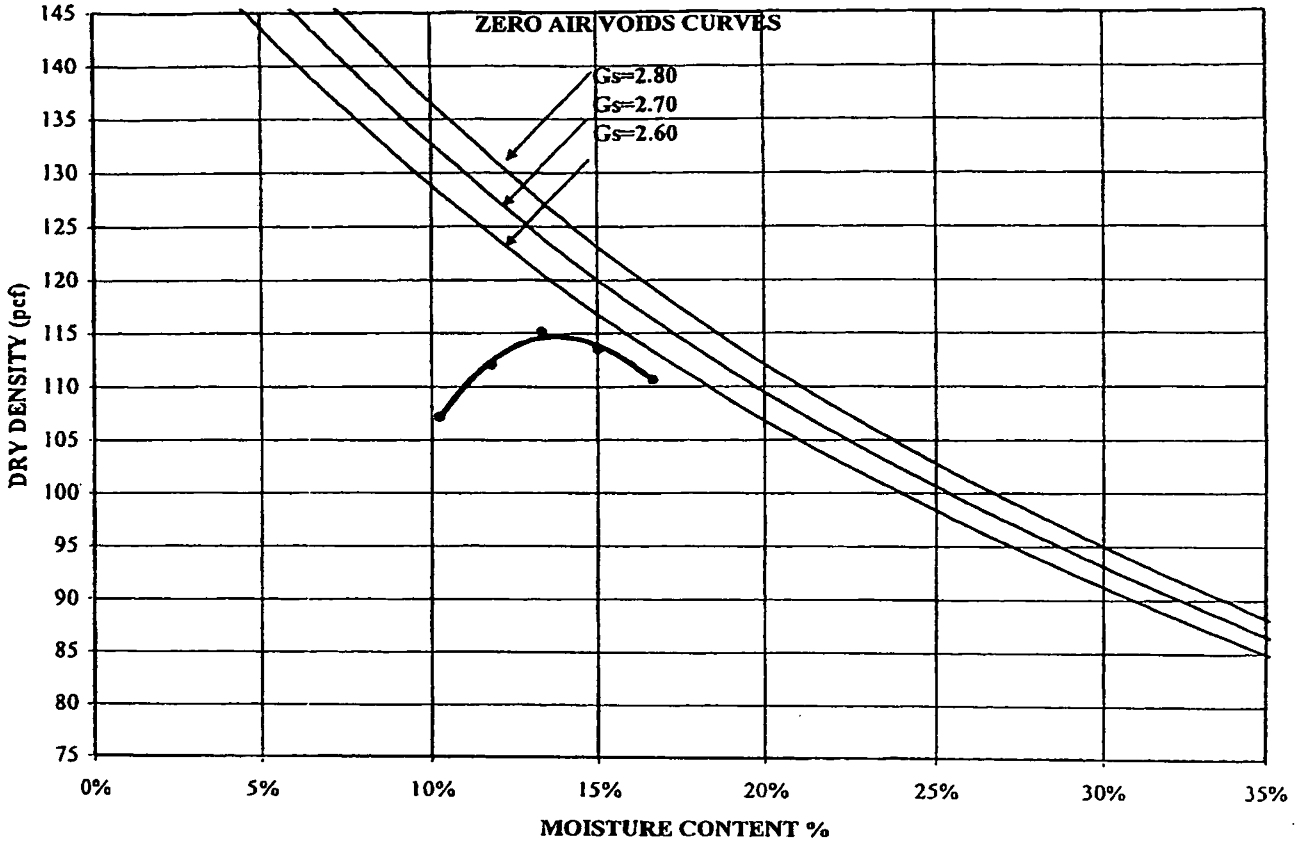
MOISTURE / DRY DENSITY CURVE
D 698 METHOD A

CPF-1



MAXIMUM DRY DENSITY (pcf)	115.1	Corrected Maximum Dry Density (pcf)	119.3
OPTIMUM MOISTURE (%)	13.4	Corrected Optimum Moisture (%)	12.1

SAMPLE ID	CPF-1
SAMPLE TYPE	Pail
SAMPLE DEPTH	-

LL	37
PL	17
PI	20
MC	#DIV/0!

DESCRIPTION: Moderate yellowish brown clayey sand

USCS: SC

Kaiser Hill/Rocky Flats Field & Lab
053-2203-0001

TECH	MKS
DATE	5-11-05
REVIEW	MB

Golder Associates

ENGINEERING CHANGE REQUEST

PROJECT	**Cover Original Landfill**	ECR NO.	002
JOB NUMBER	**T0113090**	PAGE	1 OF 2
LOCATION	**RFETS**	ECR DATE	5/18/2005
		REPLY DATE	5/26/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Buttress	LOCATION	Rocky Flats OLF
DRAWING NO.	51788-011	SPEC. NO.	

CHANGE REQUESTED

Continue cover fill down the 3:1 south slope of the buttress. This additional cover will replace two feet of buttress fill to maintain current control points. This configuration will eliminate the diversion berms on the south slope. The cover material will be the same RFA used for cover fill elsewhere and will be place and compacted using a Cat D-6 or similar equipment tracking vertically on the slope.

See Basic drawing attached

REPLY REQUIRED BY 5/19/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE | DATE

POTENTIAL IMPACT NOTICE
__ SCHEDULE
X LABOR
X MATERIAL
__ NO IMPACT
__ OTHER ________

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

The engineering change request (ECR) to substitute 2 feet of Rocky Flats Alluvium cover fill for the top 2 feet of buttress fill down the 3:1 slope is approved. Place and compact cover fill in accordance with Specification 02221 (two, 1-foot lifts pushed up from the bottom with a D-6 or similar). Install NAG C350 (or equivalent) erosion control matting on the lower vertical 10 feet of the 3:1 slope with approximately 2 inches soil on matting. Install NAG C125 (or equivalent, preferably of natural biodegradable material) erosion matting on the remainder of the 3:1 buttress slope. Overlap, anchor, embed, and staple each according to manufactures instructions for installation

This modification will also eliminate the need for the surface water diversion berms on the 3:1 buttress slope, as well as the outfalls from these berms. Design drawings 08, 09, 11 and detail 5 of drawing 12A will be revised to reflect this ECR. Design Appendix C (Rainfall Soil Erosion and Wind Erosion Loss), and Design Appendix D (Surface Water Management System Assessment) have also been revised to support and reflect the removal of the 3:1 buttress slope diversion berms. Revised calculation packages and revised drawings are included with this ECR response.

RM [signature] DATE 5/27/05

DM [signature] DATE 5/26/05

CQAE [signature] DATE 5/31/05

CDPHE REPRESENTATIVE Carl Spreng DATE 6/8/05

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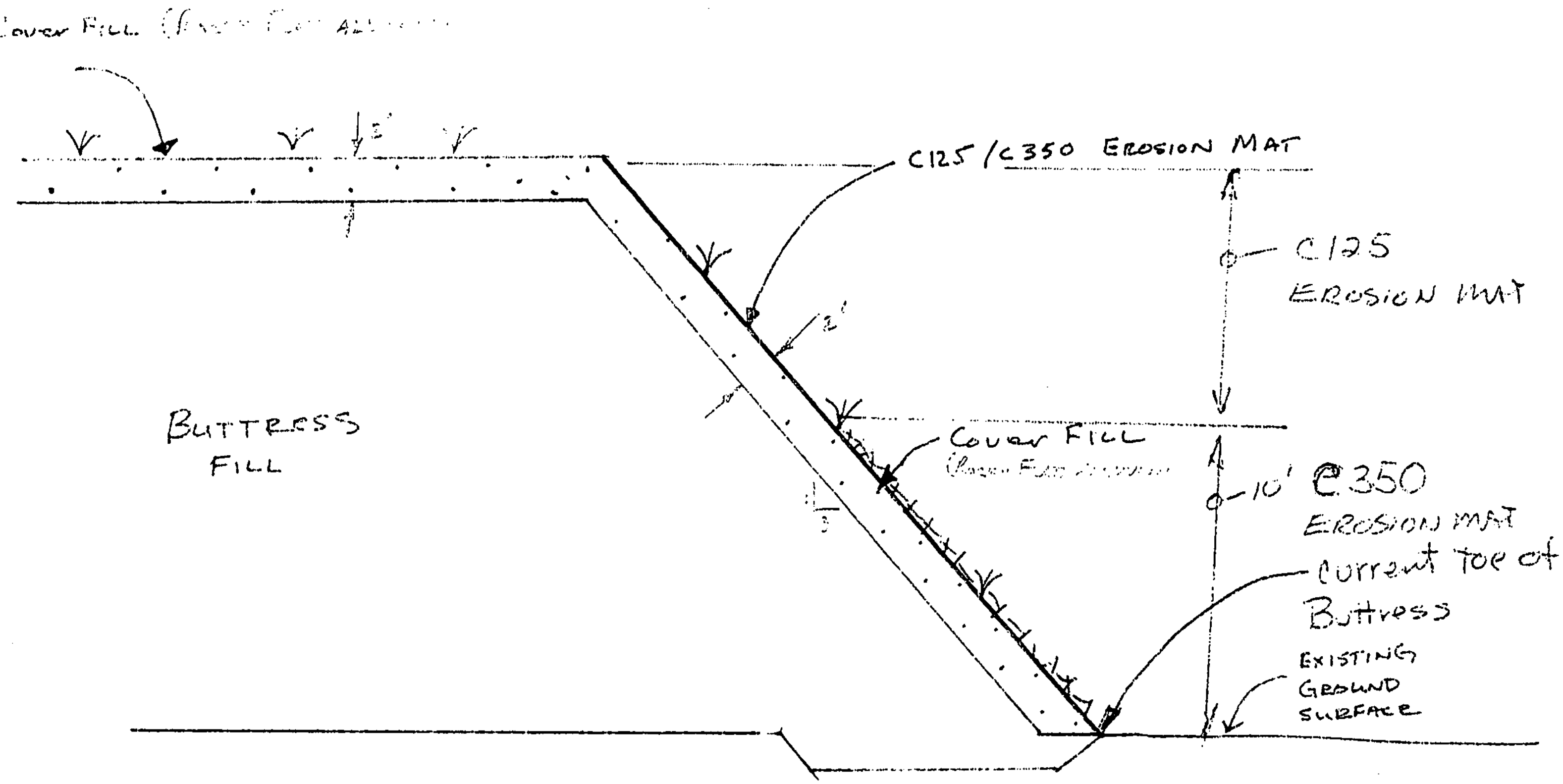

Buttress X-Section

NTS

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ENGINEERING CHANGE REQUEST 002

RAINFALL SOIL EROSION AND WIND EROSION LOSS CALCULATIONS

(REVISED FINAL DESIGN APPENDIX C)

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
ACCELERATED ACTION DESIGN FOR THE ORIGINAL LANDFILL

MAY 19, 2005

Prepared by:

Earth Tech, Inc.
5575 DTC Parkway, Suite 200
Englewood, Colorado 80111
(303) 694-6660

This calculation was performed by Earth Tech, Inc. Although each sheet composing this calculation may or may not be initialed, it has nonetheless been reviewed and checked.

Prepared By:	RA	Date: 5/19/05
Checked By:	RT	Date: 5/19/05
Approved By:	RT	Date: 5/19/05

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EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
5575 DTC Parkway, Suite 200
Englewood, Colorado 80111

Project: RFETS – Original Landfill Accelerated Action   Project No. 57378.6040   Date: 5/19/05

Subject: Landfill Engineering – Rainfall Soil Erosion and Wind Erosion Loss Calculations

By: RA Date: 5/19/05 Chk By: RT Date: 5/19/05 App By: RT Date: 5/19/05

LIST OF TABLES

LIST OF ATTACHMENTS

EARTH TECH
A tyco INTERNATIONAL LTD COMPANY
5575 DTC Parkway, Suite 200
Englewood, Colorado 80111

Project: RFETS – Original Landfill Accelerated Action Project No. 57378.6040 Date: 5/19/05

Subject: Landfill Engineering – Rainfall Soil Erosion and Wind Erosion Loss Calculations

By: RA Date: 5/19/05 Chk By: RT Date: 5/19/05 App By: RT Date: 5/19/05

1.0 INTRODUCTION

Engineering change request (ECR) 002 requests that Rocky Flats Alluvium (RFA) be used to cover the buttress sideslope rather than "pit-fines" as originally designed. This calculation is therefore a revision of Appendix C included in the Final Design Package. Attachments 2 through 5 can be found in the Final Design submittal and are not included again.

The purpose of this calculation is to determine the erosion following seeding, the erosion after the vegetation has been established, and the long term erosion if vegetation does not establish on the final cover slopes at the Original Landfill located on the Rocky Flats Environmental and Technology Site (RFETS).

2.0 LANDFILL DESCRIPTION AND LOCATION

The Original Landfill site is located south of RFETS Buildings 440 and 460, along the north hillside of a ravine in the Woman Creek drainage area, extending from approximate Elevation 6,040 feet at the top to Elevation 5,950 feet at its base. Waste operations began in the early 1950s and continued through 1968. The Original Landfill site footprint has a maximum length along the east-west direction of approximately 1,700 feet, and approximately 500 feet in the north-south direction, with an approximate area on the order of 20 acres. Existing slope gradients range from approximately flatter than 6 to 1 (horizontal to vertical) to 2 to 1, with a total slope height from the top of the hillside to the Woman Creek drainage of about 90 feet.

As part of the accelerated action at the Original Landfill, the existing slopes will be regraded to overall 18 percent slope with 2-foot soil cover and drainage improvements. In addition, a buttress fill at the toe of the landfill will be installed for stability enhancements.

3.0 REFERENCES

Potential erosion for the Original Landfill was evaluated using guidelines provided in the following documents:

1. "Technical Guidance For RCRA/CERCLA Final Covers." U.S. EPA, Office of Solid Waste and Emergency Response, April 2002.

2. "Regulations Pertaining to Solid Waste Disposal Sites and Facilities" (Regulations). 6 Colorado Code of Regulations (CCR) 1007-2, Colorado Department of Public Health and Environment.

3. "Guidelines for the Use of the Revised Universal Soil Loss Equation (RUSLE)." Version 1.06. Terrance J. Toy and George R. Foster, August 1998.

4. "National Agronomy Manual." United States Department of Agriculture (USDA), October 2002.

5. Soil Survey of Golden Area, Colorado. USDA, 1980.

E A R T H T E C H
A tyco INTERNATIONAL LTD COMPANY
5575 DTC Parkway, Suite 200
Englewood, Colorado 80111

Project: RFETS – Original Landfill Accelerated Action Project No. 57378.6040 Date: 5/19/05

Subject: Landfill Engineering – Rainfall Soil Erosion and Wind Erosion Loss Calculations

By: RA Date: 5/19/05 Chk By: RT Date: 5/19/05 App By: RT Date: 5/19/05

4.0 DESIGN CRITERIA

The attached calculations were used to evaluate the potential for rainfall and wind erosion at the Original Landfill and to determine whether additional erosion control measures are required. Evaluation of potential rainfall and wind erosion of the Original Landfill was based on the following design criteria:

1. The Original Landfill consists of an 18% slope and a maximum drainage distance of approximately 150 feet using diversion berms. The diversion berm spacing was determined in Appendix D to minimize diversion berm watershed areas to allow the use of check dams to control sediment. The cover slope will be constructed with Rocky Flats Alluvium (RFA).

2. The buttress fill consist of a 3H:1V (33%) sideslopes and a maximum drainage distance of 65 feet. The buttress will be covered with RFA on the top and side slopes. Erosion from channel sideslopes will be less than buttress fill sideslopes due to smaller flow lengths Therefore, any calculation done for the buttress sideslope can be assumed to be the same as the channel sideslopes.

3. As guidance only, the design erosion rate shall not exceed 2.0 tons/acre/year per Section 2.2.5.3 of the Technical Guidance for RCRA/CERCLA Final Covers (EPA 2002).

4. A.) The annual production of native grasses at RFETS is 1.26 grams per square meter (g/m^2) or 1,128 lbs/acre, based on data provided by Jody Nelson, Senior Ecologist at RFETS. The number was derived from a 1993/1994 study when the annual rainfall was 12.0-12.5 inches or below the average of 15 inches.

   B.) Erosion calculations will be performed on the cover soils without vegetation to understand the significance or lack of significance of vegetation on the long term integrity of the soil cover.

5.0 CALCULATIONS

5.1 RAINFALL EROSION CALCULATION METHODOLOGY

The soil erosion rate due to rainfall was calculated using the Revised Universal Soil Loss Equation (RUSLE). The RUSLE predicts the average soil losses in runoff from a given site based on specific physical and management erosion variables. The soil loss equation is as follows:

$$A = R \times K \times LS \times C \times P$$

Where:

- A is the computed soil loss per unit area in tons per acre per year
- R is the rainfall and runoff factor which varies with location and climate
- K is the soil erodibility factor

- **LS** is the topographic factor (slope-length factor/slope steepness factor) that accounts for the site slope gradient and length of slope
- **C** is the cover and management factor that accounts for the ground cover (grass, weeds, etc.)
- **P** is the support practice factor that accounts for contouring, terracing, or other runoff control devices

The USDA has developed a program that computes rainfall soil erosion using data for different sections of the country. This data is contained in databases that have been incorporated into the RUSLE program. Input values for the RUSLE software program are based on site-specific information and a database of information that is part of the RUSLE program. Version 2 of the RUSLE program was downloaded from http://bioengrgr.ag.utk.edu/rusle2/ for use in these calculations. Use of this software is suggested by the Technical Guidance for RCRA/CERCLA Final Covers (EPA 2002).

5.1.1 RAINFALL EROSION CALCULATIONS

All RUSLE factors are determined by the software or entered manually and the tons/acre/year of rainfall erosion is then computed. The factors used are as follows:

R Determination

The rainfall and runoff factor is the average annual total of the storm energy and intensity values in a given location. The R factor for the Denver, Colorado area is 40.

$R = 40$

K Determination

Sieve analysis results from the Centennial Quarry (potential borrow area) of RFA with rock fragments removed shows, according to the USDA system (USCS sieve data and USDA textural triangle found in Attachment 5 – APR-1 used due to a greater percentage of fines), a classification of sandy loam. For this analysis, a classification of sandy loam with 30% rock fraction is used as a conservative approach resulting in an erodibility factor of 0.283. However, the sieve analyses show that the fraction of rock larger than 1-inch in the RFA is greater than 40%.

$K_{RFA} = 0.283$

Alternatively, the K factor for RFA to determine the long-term erodibility can be determined from the Soil Survey of Golden Area, Colorado (USDA 1980). As shown on the map from the Soil Survey (Attachment 3), the RFA falls under the number 45 soil type. Table 15 (Attachment 3) of the Soil Survey shows a K factor of 0.05 for the undisturbed or natural state of the top 13 inches of type 45 soils. This K factor is used to determine the long term rain erosion if the planted vegetation does not fully establish and the soil has returned to a natural state with higher percentages of rock exposed.

$K_{RFA\text{-}mature} = 0.05$

LS Determination

The LS factor is a combination of the slope length factor and the slope steepness factor. The software uses the input slope length and input slope steepness or grade to calculate the LS. In addition, the software accounts for the changes in the length factor based on erosional rill or small erosional channel development. For this reason, the LS factors vary for each condition, i.e. bare, mulch, or grass. The soil erodibility factor, K, has no affect on the LS determination resulting in identical LS factors for bare with K equal to 0.283 and bare with K equal to 0.05. The cover slope is a maximum of 150 feet with an 18% assuming diversion berms are placed every 150 feet. The buttress fill sideslope is 65 feet with a 33% slope. The LS is then computed.

$LS_{cover\text{ - }bare} = 3.44$ $LS_{buttress\text{ - }bare} = 4.50$
$LS_{cover\text{ - }mulch} = 3.55$ $LS_{buttress\text{ -}mulch} = 4.48$
$LS_{cover\text{ - }grass} = 3.25$ $LS_{buttress\text{ - }grass} = 4.54$

C Determination

To calculate the cover management factor, the software requires input of the management of the soil. The cover will be bladed, seeded, and mulched. Once the vegetation is established, the management factor is based on "dense grass" or the grass condition typical at Rocky Flats as described the Section 4.0, number 4. The soil erodibility factor, K, has no affect on the C determination resulting in identical C factors for bare with K equal to 0.283 and bare with K equal to 0.05.

$C_{cover\text{ - }bare} = 0.191$ $C_{buttress\text{ - }bare} = 0.183$
$C_{cover\text{ - }mulch} = 0.086$ $C_{buttress\text{ - }mulch} = 0.078$
$C_{cover\text{ - }grass} = 0.051$ $C_{buttress\text{ - }grass} = 0.049$

P Determination

The support practice factor accounts for any runoff control devices such as contours or terraces (diversion berms). P is also affected by ridges caused by depositing sediment on the slope when runoff is occurring. The soil erodibility factor, K, has no affect on the P determination resulting in identical P factors for bare with K equal to 0.283 and bare with K equal to 0.05. These ridges are only a small factor and therefore the numbers are close to 1.00 and have little affect on the calculation.

$P_{cover\text{ - }bare} = 0.985$ $P_{buttress\text{ - }bare} = 1.00$
$P_{cover\text{ - }mulch} = 1.02$ $P_{buttress\text{ - }mulch} = 1.00$
$P_{cover\text{ - }grass} = 0.985$ $P_{buttress\text{ - }grass} = 1.00$

A Determination

The factors are then used to obtain the soil loss in tons/acre/year. RUSLE software input and output can be found in Attachment 1. The "dense grass" condition represents 1,120 lbs/acre of native grass (see Section 4.0). The K factors were varied to represent erosion using the RUSLE software and the SCS numbers. RUSLE software output is as follows:

Table C-1
Original Landfill - Rain Erosion

CONDITION	COVER SLOPE RFA (K=0.283)	COVER SLOPE RFA (K=0.05)	BUTTRESS SIDESLOPE RFA (K=0.283)	BUTTRESS SIDESLOPE RFA (K=0.05)
Bare Disturbed soil immediately after construction with no erosion control	7.5 tons/acre/year	1.3 tons/acre/year	9.6 tons/acre/year	1.7 tons/acre/year
Seed/Mulch Disturbed soil immediately after construction with seed and mulch	3.6 tons/acre/year	NA	4.0 tons/acre/year	NA
Temporary Erosion Control Disturbed soil immediately after construction with seed, mulch and temporary erosion mat	0.53 tons/acre/year	NA	0.87 tons/acre/year	NA
Established Vegetation	1.9 tons/acre/year	0.34 ton/acre/year	2.6 tons/acre/year	0.45 tons/acre/year

As evident in the RUSLE output, using a K of 0.283 for the cover slope and buttress sideslope results in rain erosion above or near the guidance criteria with bare conditions and following seed/mulch. Because the seed/mulch condition is above the guidance, temporary erosion control must be used following seeding. Since erosion mat will be used, mulch application is not required by the design though mulch may be applied following seeding.

On the cover slope, as vegetation established, the rain erosion rate with temporary erosion mat is 0.53 tons/acre/year. With established vegetation the rain erosion rate is 1.9 tons/acre/year and decreases to 0.34 tons/acre/year as RFA matures.

On the buttress sideslope, as vegetation established, the rain erosion rate with temporary erosion mat is 0.87 tons/acre/year. With established vegetation the rain erosion rate is 2.6 tons/acre/year and decreases to 0.45 tons/acre/year as RFA matures. Though not required as determined in Appendix E, NAG C350 or equivalent will be placed 10-feet up the bottom slope as an enhancement to erosion control due to Woman Creek flow.

5.2 WIND EROSION LOSS CALCULATION METHODOLOGY

Wind erosion on the Original Landfill was determined with the Wind Erosion Equation (WEQ) using the methodology provided in the National Agronomy Manual (NAM) (USDA 2002) (Attachment 2).

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Englewood, Colorado 80111

Project: RFETS – Original Landfill Accelerated Action | Project No. 57378.6040 | Date: 5/19/05

Subject: Landfill Engineering – Rainfall Soil Erosion and Wind Erosion Loss Calculations

By: RA Date: 5/19/05 Chk By: RT Date: 5/19/05 App By: RT Date: 5/19/05

5.2.1 WEQ CALCULATIONS

The following determination of wind erosion uses the WEQ found in the NAM (Attachment 2). The WEQ is not a straight-line mathematical relationship but is a function of several factors. The WEQ is as follows:

$E = f(IKCLV)$

Where:

- E = estimated average annual soil loss due to wind (tons/acre/year)
- f = function of (not a straight-line mathematical relationship)
- I = soil erodibility index
- K = soil surface roughness factor
- C = climatic factor
- L = the unsheltered distance
- V = the vegetative cover factor

I Determination

The Soil Survey of Golden Area, Colorado (USDA 1980) was used to help determine the soil erodibility index or I factor. As shown on the map from the Soil Survey (Attachment 3), RFA falls under the number 45 soil type. Table 15 (Attachment 3) of the Soil Survey shows a wind erodibility group (WEG) of 8 for the type 45 soil.

The I factor is then determined using Exhibit 502-2 of the NAM (Attachment 2). As shown on Exhibit 502-2, WEG 8 is not susceptible to wind erosion. However, it is assumed that wind erosion of disturbed soil immediately after construction will occur at the OLF so a different WEG is selected. Sieve analysis results from Centennial Quarry RFA with rock fragments removed (Attachment 5) shows, according to the USDA system, a sandy loam falls under WEG 3 which has a soil erodibility index of 86 tons/acre/year.

$I_{WEG\,3} = 86$

WEG 8 is used to determine the long term wind erosion if the planted vegetation does not fully establish and the soil has returned to a natural state with higher percentages of rock exposed.

$I_{WEG\,8} = 0$

K Determination

The soil roughness factor (K) considers both ridge roughness (K_{rd}) and random roughness (K_{rr}) values. Values closer to 1.0 for both the K_{rd} and the K_{rr} equate to shorter ridge heights and less wind dissipation by random roughness. Shorter ridge heights and less random roughness lead to greater soil wind erosion because ridges absorb and deflect wind energy and trap moving particles (NAM Section 502.32). Figure 502-4 (page 502-10 of the NAM) shows that at a 0 inch ridge height, K_{rd} is equal to 1.00. Exhibit 502-6 (Table 502-6) shows that at a short random roughness of 0.2 the K_{rr} is 1.00. The K factor is obtained by multiplying K_{rd} by K_{rr}.

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$K = (K_{rd})(K_{rr})$
$K = (1.00)(1.00) = 1.00$

$K = 1.00$ (conservative approach)

C Determination

The climatic factor (C) is an index of the factor accounting for wind speed and surface soil moisture of a given region (NAM Section 502.33). As outlined in Section 502.33 of the NAM, the C factor is determined by use of isoline maps found at the NRCS/USDA website. The figure at the end of Attachment 2 shows the isoline map for the Rocky Flats area.

$C = 30$

L Determination

The L factor is the unsheltered distance along the prevailing wind erosion direction. Wind-rose diagrams for Rocky Flats found in Attachment 5 show a prevailing wind of W-NW. As shown in Attachment 4, the longest distance on the OLF from the W-NW is 1070 feet.

$L = 1070$ feet

V Determination

The vegetative cover factor (V) is the equivalent in pounds per acre of small-grain residue provided by the cover crop. Using the tables in Exhibit 502-10, Figure a-1 for mulch (flat winter wheat residue) and Figure d-8 for ungrazed mixtures of grass, the V factor is determined. For bare conditions, the V factor is assumed to be 0. For mulch or flat winter wheat residue, the V factor is determined by assuming 3,000 lbs/acre of mulch or small grain residue will be applied (4,000 lbs/acre will actually be placed). This 3,000 lbs/acre of small grain residue results in an equivalent flat small grain residue (V factor) of 3,700 lbs/acre. For the native grasses, 1,128-lbs/acre yield (rounded down to 1,100 lbs/acre) discussed in Section 4.0 is used which results in an equivalent flat small grain residue (V factor) of 2,600 lbs/acre.

$V_{Bare} = 0$ lbs/acre
$V_{Mulch} = 3,700$ lbs/acre
$V_{Grass} = 2,600$ lbs/acre

E Determination

As discussed in Section 502.30 of the NAM, the soil loss due to wind erosion, or E factor, is determined using E tables found on the Kansas State University website.

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Sheet C8

Project: RFETS – Original Landfill Accelerated Action   Project No. 57378.6040   Date: 5/19/05

Subject: Landfill Engineering – Rainfall Soil Erosion and Wind Erosion Loss Calculations

By: RA Date: 5/19/05 Chk By: RT Date: 5/19/05 App By: RT Date: 5/19/05

The table matching the factors determined for the OLF (I=86, K=1.00, C=30, L=1070, and V=0, 2,600, and 3,700) is shown at the end of Attachment 2 (Subpart G – Exhibits). The tables do not include V factors above 1,500 lbs/acre because the wind erosion with these factors is negligible. Therefore, a V factor of 1,500 lbs/acre is assumed for both mulch and established grass on the cover slope. The same factors are used for the buttress sideslope (I=86, K=1.00, C=30, L=1070, and V=0, 2,600, and 3,700) a V factor of 1,500 lbs/acre is assumed for both mulch and established grass. For both the cover slope and the buttress, it is assumed that wind erosion with erosion mat is the same as that of mulch. Using these factors the wind erosion is as follows:

Table C-2
Original Landfill - Wind Erosion

CONDITION	COVER SLOPE RFA (WEG=3)	COVER SLOPE RFA (WEG=8)	BUTTRESS SIDESLOPE (WEG=3)	BUTTRESS SIDESLOPE (WEG=8)
Bare Disturbed soil immediately after construction with no erosion control	21.6 tons/acre/year	0.0 tons/acre/year	21.6 tons/acre/year	0.0 tons/acre/year
Seed/Mulch Disturbed soil immediately after construction with seed and mulch	0.60 tons/acre/year	NA	0.60 tons/acre/year	NA
Temporary Erosion Control Disturbed soil immediately after construction with seed, mulch and temporary erosion mat	0.60 tons/acre/year	NA	0.60 tons/acre/year	NA
Established Vegetation	0.60 tons/acre/year	0.0 tons/acre/year	0.60 tons/acre/year	0.0 tons/acre/year

6.0 CONCLUSIONS

The table below presents the results of both the rain and wind erosion calculations:

Table C-3
Original Landfill - Total Erosion

CONDITION	COVER SLOPE RFA (tons/acre/year)	COVER SLOPE MATURE RFA (tons/acre/year)	BUTTRESS SIDESLOPE RFA (tons/acre/year)	BUTTRESS SIDESLOPE MATURE RFA (tons/acre/year)
Bare Disturbed soil immediately after construction with no erosion control	Rain: 7.50 Wind: 21.6 Total: 29.1	Rain: 1.30 Wind: 0.00 Total: 1.30	Rain: 9.60 Wind: 21.6 Total: 31.2	Rain: 1.70 Wind: 0.00 Total: 1.70
Seed/Mulch Disturbed soil immediately after construction with seed and mulch	Rain: 3.60 Wind: 0.60 Total: 4.20	NA	Rain: 4.00 Wind: 0.60 Total: 4.60	NA
Temporary Erosion Control Disturbed soil immediately after construction with seed, mulch and temporary erosion mat	Rain: 0.53 Wind: 0.60 Total: 1.13	NA	Rain: 0.87 Wind: 0.60 Total: 1.47	NA
Established Vegetation	Rain: 1.90 Wind: 0.60 Total: 2.50	Rain: 0.34 Wind: 0.00 Total: 0.34	Rain: 2.60 Wind: 0.60 Total: 3.20	Rain: 0.45 Wind: 0.00 Total: 0.45

Cover Slope

On the cover slope, the design of the Original Landfill (including diversion berms) will meet the guidance criteria for erosion of 2 tons/ac/yr with Rocky Flats Alluvium in its mature state. The following is recommended until this condition is reached:

- The initial disturbed soil will be seeded and covered with 3-year longevity erosion control mat.
- As vegetation establishes, the erosion mat degrades, the total erosion is predicted at 1.13 tons/acre/year.
- As the surface matures, exposing more of the rock fraction of the RFA, the erosion rate is predicted to be 0.34 tons/ac/year if vegetation is established and 1.30 if not.
- Should the vegetation not establish or climatic conditions exist to reduce the vegetation, the erosion rate will not increase beyond that of the bare, mature Rocky Flats Alluvium of 1.30 tons/ac/year (below the guidance criteria).

Buttress Sideslopes

On the buttress sideslope, the design of the Original Landfil will meet the guidance criteria for erosion of 2 tons/ac/yr with Rocky Flats Alluvium in its mature state. The following is recommended until this condition is reached:

- The initial disturbed soil will be seeded and covered with 3-year longevity erosion control mat.
- As vegetation establishes, the erosion mat degrades, the total erosion is predicted at 1.47 tons/acre/year.
- As the surface matures, exposing more of the rock fraction of the RFA, the erosion rate is predicted to be 0.45 tons/ac/year if vegetation is established and 1.70 if not.
- Should the vegetation not establish or climatic conditions exist to reduce the vegetation, the erosion rate will not increase beyond that of the bare, mature Rocky Flats Alluvium of 1.70 tons/ac/year (below the guidance criteria).

Summary

The erosion calculations demonstrate that when RFA on the cover and the buttress sideslope reaches a mature state, vegetation is not required to meet the EPA guidance criteria of 2 tons/acre/year and to protect the soil cover. However, the design of the soil cover will include seeding, mulching, and erosion mat to develop vegetation as discussed in the Original Landfill IM/IRA.

APPENDIX C

ATTACHMENT 1
RUSLE INPUT/OUTPUT

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COVER SLOPE EROSION (K = 0.283)

Tract # RFETS OLF
Owner name RFETS OLF
Field # RFETS OLF
Info

Compare management alternatives for a single hillslope profile | Compare individual hillslope profiles | Compute avg. soil loss for a field/watershed |

Location: Colorado\Denver
Soil: z OSM\sandy loam-20% stone
Slope length (horiz), ft: 150
Avg. slope steepness, %: 18

Slope Topography

Segment	Steepness, %	Length along slope, ft
1	18	152

Insert control...
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Management alternative table

Temp. scenario	Base management	Residue burial level	General yield level	Contouring	Strips/barriers	Diversion/terrace sediment ba	Surf. cov. values	Detachment on slope, t/ac/yr	Soil loss erod. portion, t/ac	Soil loss for cons. plan, t/ac/yr	Sediment delivery, t/ac/yr
Profile	bare	Normal	Normal	default	(none)	(none)	cover	7.5	7.5	7.5	7.5
Profile	M\blade fil, seed, straw mulch	Normal	Normal	default	(none)	(none)	cover	3.6	3.6	3.6	3.6
Profile	dense grass	Normal	Normal	default	(none)	(none)	cover	1.9	1.9	1.9	1.9

COVER SLOPE EROSION (K = 0.05)

Tract # RFETS OLF
Owner name RFETS OLF
Field # RFETS OLF
Info

Compare management alternatives for a single hillslope profile | Compare individual hillslope profiles | Compute avg. soil loss for a field/watershed |

Location: Colorado\Denver
Soil: z OSM\sandy loam-20% stone
Slope length (horiz), ft: 150
Avg. slope steepness, %: 18

Slope Topography

Segment	Steepness, %	Length along slope, ft
1	18	152

Management alternative table

Temp. scenario	Base management	Residue burial level	General yield level	Contouring	Strips/barriers	Diversion/terrace sediment ba	Surf. cov. values	Detachment on slope, t/ac/yr	Soil loss erod. portion, t/ac	Soil loss for cons. plan, t/ac/yr	Sediment delivery, t/ac/yr
Profile	bare	Normal	Normal	default	(none)	(none)	cover	1.3	1.3	1.3	1.3
Profile	dense grass	Normal	Normal	default	(none)	(none)	cover	0.34	0.34	0.34	0.34

COVER SLOPE EROSION WITH TEMPORARY EROSION MAT

The RUSLE software does not contain erosion mat as an alternative for "Base management". North American Green C125 temporary erosion mat has a cover factor (C in the RUSLE) of 0.07 (NAG C125 Performance Specification for slopes >50 feet). To calculate the soil loss on the cover with C125, the "bare" cover erosion is multiplied by an additional cover factor of 0.07. This simulates the condition following seeding with C125 applied to the soil cover.

A (bare) = (7.5 ton/ac/yr)(0.07) = 0.53 ton/ac/yr

BUTTRESS FILL SIDESLOPES (K=0.283)

Tract # RFETS OLF
Owner name RFETS OLF
Field # RFETS OLF
Info

Compare management alternatives for a single hillslope profile | Compare individual hillslope profiles | Compute avg. soil loss for a field/watershed

Location: Colorado\Denver
Soil: z OSM\sandy loam-20% stone
Slope length (horiz), ft: 65
Avg. slope steepness, %: 33

Slope Topography

Segment	Steepness %	Length along slope ft
1	33	68

Management alternative table

Temp. scenario	Base management	Residue burial level	General yield level	Contouring	Strips/barriers	Diversion/terrace, sediment basin	Surf. cov. values	Detachment on slope t/ac/yr	Soil loss erod. portion, t/ac	Soil loss for cons. plan, t/ac/yr	Sediment delivery t/ac/yr
Profile	bare	Normal	Normal	default	(none)	(none)	... cover	9.6	9.6	9.6	9.6
Profile	M\blade fill, seed, straw mulch	Normal	Normal	default	(none)	(none)	... cover	4.0	4.0	4.0	4.0
Profile	dense grass	Normal	Normal	default	(none)	(none)	... cover	2.6	2.6	2.6	2.6

BUTTRESS FILL SIDESLOPES (K=0.05)

Tract # RFETS OLF
Owner name RFETS OLF
Field # RFETS OLF
Info

Compare management alternatives for a single hillslope profile | Compare individual hillslope profiles | Compute avg. soil loss for a field/watershed

Location: Colorado\Denver
Soil: z OSM\sandy loam-20% stone
Slope length (horiz), ft: 65
Avg. slope steepness, %: 33

Slope Topography

Segment	Steepness %	Length along slope ft
1	33	68

Management alternative table

Temp. scenario	Base management	Residue burial level	General yield level	Contouring	Strips/barriers	Diversion/terrace, sediment basin	Surf. cov. values	Detachment on slope t/ac/yr	Soil loss erod. portion, t/ac	Soil loss for cons. plan, t/ac/yr	Sediment delivery t/ac/yr
Profile	bare	Normal	Normal	default	(none)	(none)	... cover	1.7	1.7	1.7	1.7
Profile	dense grass	Normal	Normal	default	(none)	(none)	... cover	0.45	0.45	0.45	0.45

BUTTRESS SIDESLOPE TEMPORARY EROSION MAT

With the use of RFA on the buttress sideslope, established vegetation and mature RFA is sufficient to minimize erosion. Temporary erosion mat will be required until this condition is reached. North American Green C125 temporary erosion mat has a cover factor (C in the RUSLE) of 0.09 (NAG C125 Performance Specification for 3:1 slopes and >50 foot flow distance). To calculate the soil loss on the cover with C125, the "bare" cover erosion is multiplied by an additional cover factor of 0.09. This simulates the condition following seeding with C125 applied to the soil cover.

A (bare) = (9.6 ton/ac/yr)(0.09) = 0.87 ton/ac/yr

APPENDIX C
(SEE FINAL DESIGN)

ATTACHMENT 2
NATIONAL AGRONOMY MANUAL

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APPENDIX C
(SEE FINAL DESIGN)

ATTACHMENT 3
SOIL SURVEY OF GOLDEN AREA, COLORADO

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APPENDIX C
(SEE FINAL DESIGN)

ATTACHMENT 4
PREVAILING WIND INFORMATION

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APPENDIX C

ATTACHMENT 5
(SEE FINAL DESIGN)
GEOTECHNICAL DATA

ENGINEERING CHANGE REQUEST 002

SURFACE WATER MANAGEMENT SYSTEM ASSESSMENT

(REVISED FINAL DESIGN APPENDIX D)

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
ACCELERATED ACTION DESIGN FOR THE ORIGINAL LANDFILL

MAY 19, 2005

Prepared by:

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This calculation was performed by Earth Tech, Inc. Although each sheet composing this calculation may or may not be initialed, it has nonetheless been reviewed and checked.

Prepared By:	RA	Date: 5/19/05
Checked By:	RT	Date: 5/19/05
Approved By:	RT	Date: 5/19/05

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Project: RFETS – Original Landfill Accelerated Action Project No. 57378.6020 Date: 5/19/05

Subject: Landfill Engineering – Surface Water Management System Assessment

By: RA Date: 5/19/05 Chk By: RT Date: 5/19/05 App By: RT Date: 5/19/05

LIST OF TABLES

LIST OF ATTACHMENTS

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1.0 INTRODUCTION

Engineering change request (ECR) 002 requests that Rocky Flats Alluvium (RFA) be used to cover the buttress sideslope rather than "pit-fines" as originally designed. This led to the revision of Appendix C (Rainfall Soil Erosion and Wind Erosion Loss Calculations). Revised Appendix C showed that with the use of RFA on the buttress sideslope, diversion berms are no longer necessary to reduce overland flow on the buttress sideslope. Since diversion berms are no longer necessary, the surface water management system assessment requires revision. This calculation is therefore a revision of Appendix D included in the Final Design package.

This Surface Water Management Plan was developed to address potential storm water impacts the Original Landfill Accelerated Action may have to the surrounding area.

This Plan addresses two elements:

1. Surface water control structures that will be required to adequately convey the run-on to and run-off from the Original Landfill due to a 100-year 24-hour storm event with freeboard capacity to handle the 1000-year 24-hour storm event.

2. Reduce sediment transport following construction while the landfill area is disturbed. Once vegetation is established, conditions will be similar to surrounding areas.

2.0 LANDFILL DESCRIPTION, LOCATION AND DRAINAGE

The Original Landfill site is located south of RFETS Buildings 440 and 460, along the north hillside of a ravine in the Woman Creek drainage area, extending from approximate Elevation 6,040 feet at the top to Elevation 5,950 feet at its base. Waste operations began in the early 1950s and continued through 1968. The Original Landfill site footprint has a maximum length along the east-west direction of approximately 1,700 feet, and approximately 500 feet in the north-south direction, with an approximate area on the order of 20 acres.

Due to the canyon-fill nature of the Original Landfill, minimal surface water run-on is expected to occur. Run-off will be controlled by the construction of 7 diversion berms which route water to lined channels on the west and east side. The berms were spaced no greater than 150 feet to limit sediment transport from the cover to the side channels. The proposed surface water management plan is shown on Attachment 1.

3.0 REFERENCES

The surface water management system for the Original Landfill was evaluated using guidelines provided in the following documents:

1. "SEDCAD 4 for Windows 95/98 & NT". Design Manual and User's Guide. 2001.

2. "Regulations Pertaining to Solid Waste Disposal Sites and Facilities" (Regulations), 6 CCR 1007-2, Colorado Department of Public Health and Environment.

3. "Urban Storm Drainage Criteria Manual" (Drainage Manual), Denver Urban Drainage and Flood Control District.
4. "Erosion Control Materials Design Software Version 4.2 for Windows". North American Green (NAG). 2002.

4.0 DESIGN CRITERIA

The attached model was used to evaluate the existing drainage characteristics at the Original Landfill and to size appropriate drainage structures for the Original Landfill. Evaluation and design of the Original Landfill surface water control system will meet the following design criteria:

1. Collect and control surface water run-on flow onto the closed landfill as a result of the 100-year 24-hour storm event with freeboard capacity to handle the 1000-year 24-hour storm event;
2. Collect and control surface water run-off from the landfill as a result of the 100-year 24-hour storm event with freeboard capacity to handle the 1000-year 24-hour storm event;
3. Comply with any provisions of the RFETS storm water discharge permit requirements including reduction of sediment transport;
4. Minimize site erosion;
5. Protect the integrity and effectiveness of the landfill cover; and
6. Minimize surface water management post-closure maintenance requirements.

5.0 HYDROLOGIC AND HYDRAULIC DESIGN APPROACH

The design process used to locate and size the surface water management structures at the Original Landfill is as follows:

1. The goal of the surface water management structures is to reduce the sediment delivered to Woman Creek from the disturbed areas or roughly the area between the west and east channels. The areas outside the channels will remain in native-type condition and the sediment currently generated from these native areas will not change after construction. The first step is to therefore place enough diversion berms on the cover to create smaller subwatersheds where sediment can be contained on the cover. The sediment will be controlled within the diversion berms with the use of removable geosynthetic check dams. It was determined that 7 diversion berms are needed to reduce sediment based on the 25-year 24-hour storm.
2. The 100-year 24-hour storm is then modeled to calculate the required height of the diversion berm and the channels which route the diversion berm water below the buttress fill.
3. The peak flows are modeled with NAG software to determine the required diversion berm and channel lining as well as the maximum slope and minimum bend radius of the channels.
4. The 1000-year 24-hour event is then modeled to check the freeboard capacity of the structures.

As shown in Attachment 1, overland flow is greater than 200 feet in the southern portion but the gradual slope at the top of the buttress fill reduces erosion. A check using the RUSLE shows that 220-feet of overland flow at 5% results in 1.50 tons/acre/year and 225-feet of overland flow at 2.75% results in 0.82 tons/acre/year (bare conditions – RFA prior to mature state). Erosion on the buttress sideslope is also minimal with mature RFA as shown in the revised Appendix C. Until RFA reaches a mature state, temporary erosion mat will be placed on the top and sides of the buttress.

SEDCAD4 software was used for surface water modeling at the Original Landfill. SEDCAD uses the National Resource Conservation Service (NRCS) approach for rainfall distribution and the NRCS curve number/unit hydrograph to predict peak flows. The NRCS Storm Type Distributions are considered very conservative leading to higher peak flows than almost any actual measured storm (SEDCAD 4 User's Manual).

Input into the SEDCAD software include:

- A 100-year 24-hour design storm according to the Regulations;
- A 1000-year 24-hour design storm to check freeboard capacity;
- An NRCS Type II storm;
- A rainfall depth of 5.0 inches according to the Drainage Manual for the 100-year 24-hour storm and 6.4 inches for the 1000-year 24-hour storm and 3.25 for the 25-year 24-hour storm;
- A conservative NRCS curve number of 86; and,
- A medium hydrograph response.

NAG software calculates flow depth, velocity, and hydraulic radius using the continuity equation (Q=VA) and Manning's equation. Once these are known, the shear stress on the lining material is calculated including any channel bend.

5.1 SURFACE WATER DESIGN RESULTS

The design is organized into six models:

- West channel sediment reduction;
- West channel 100-year 24-hour design;
- West channel 1000-year 24-hour check;
- East channel sediment reduction;
- East channel 100-year 24-hour design; and,
- East channel 1000-year 24-hour check.

Please see Attachment 1 for the SEDCAD models and Attachment 2 for NAG results. Since the west subwatersheds are similar, the sediment reduction model to space the check dams is based on only one of the watersheds. The same methodology was used on the east side. Results are summarized in the following table.

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Subject: Landfill Engineering – Surface Water Management System Assessment

By: RA Date: 5/19/05 Chk By: RT Date: 5/19/05 App By: RT Date: 5/19/05

Table D-1
Original Landfill – Structure Design

Structure	Slope	Shape	Minimum Bend Radius	Sideslopes	Minimum Height or Depth	Permanent Lining	Temporary Lining
West Diversion Berm 1	2%	Triangular	5 feet	5.6H:1V Uphill 3H:1V Downhill	3 feet	Grass	Erosion Mat (NAG C125)
West Diversion Berm 2	2%	Triangular	5 feet	5.6H:1V Uphill 3H:1V Downhill	3 feet	Grass	Erosion Mat (NAG C125)
West Diversion Berm 3	2%	Triangular	5 feet	5.6H:1V Uphill 3H:1V Downhill	3 feet	Grass	Erosion Mat (NAG C125)
West Channel	2-12%	Trapezoidal Min. 10-foot bottom	105 feet	3H:1V	2 feet	Erosion Mat (NAG P550)	Erosion Mat (P550) / Grass
East Diversion Berm 1	2%	Triangular	5 feet	5.6H:1V Uphill 3H:1V Downhill	3 feet	Grass	Erosion Mat (NAG C125)
East Diversion Berm 2	2%	Triangular	5 feet	5.6H:1V Uphill 3H:1V Downhill	3 feet	Grass	Erosion Mat (C125)
East Diversion Berm 3	2%	Triangular	5 feet	5.6H:1V Uphill 3H:1V Downhill	3 feet	Grass	Erosion Mat (NAG C125)
East Diversion Berm 4	2%	Triangular	5 feet	5.6H:1V Uphill 3H:1V Downhill	3 feet	Grass	Erosion Mat (NAG C125)
East Channel	2-12%	Trapezoidal Min. 18-foot bottom	200 feet	3H:1V	2 feet	Erosion Mat (NAG P550)	Erosion Mat (P550) / Grass
Typical Downstream Channel	33%	Triangular	NA	3H:1V	3 feet	Grsss	Erosion Mat (NAG C125)

Sediment reduction load was determined by placing the minimum amount of check dams within the diversion berm until the downstream dams overtop. The following was calculated based on five check dams in each diversion berm. Values are a minimum and more can be placed per berm in accordance with manufacturer's recommendations.

Table D-2
Original Landfill – Check Dam

Area	Sediment Load without Check Dams	Sediment Load with Check Dams	Minimum Check Dam Spacing
West Subwatersheds	9.5 tons	3.0 tons	130 feet
East Subwatersheds	9.0 tons	2.7 tons	200 feet

5.2 1000-YEAR 24-HOUR STORM

To determine if the freeboard capacity of the 100-year 24-hour storm is sufficient to handle the 1000-year 24-hour storm, the design was conducted with a rainfall depth of 6.4 inches. The output is provided in Attachment 2. A summary of the findings is found in the following table:

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Table D-3
Original Landfill – 1000-Year 24-Hour Comparison

Structure	100-Year Flow Depth with Freeboard (ft)	1000-Year Flow Depth without freeboard (ft)
West Diversion Berm 1	2.49	1.60
West Diversion Berm 2	2.64	1.75
West Diversion Berm 3	2.53	1.64
West Channel	1.46	0.54
East Diversion Berm 1	2.67	1.79
East Diversion Berm 2	2.67	1.79
East Diversion Berm 3	2.67	1.79
East Diversion Berm 4	2.67	1.79
East Channel	1.44	0.53

As shown in Table D-3, the design based on the 100-year 24-hour storm with freeboard is sufficient to handle surface water from the 1000-year 24-hour storm for the diversion berms.

6.0 CONCLUSIONS

Surface water management features required at the Original Landfill to achieve the design criteria listed in Section 4.0 include the following:

- Seven cover diversion berms with check dams to capture overland flow, reduce sediment load, and route it to channels.
- A permanent erosion control lined channel on the west to convey stormwater to below the buttress fill.
- A permanent erosion control/vegetation lined channel on the east to convey stormwater to below the buttress fill.

APPENDIX D

ATTACHMENT 1
SURFACE WATER DRAINGE MAP

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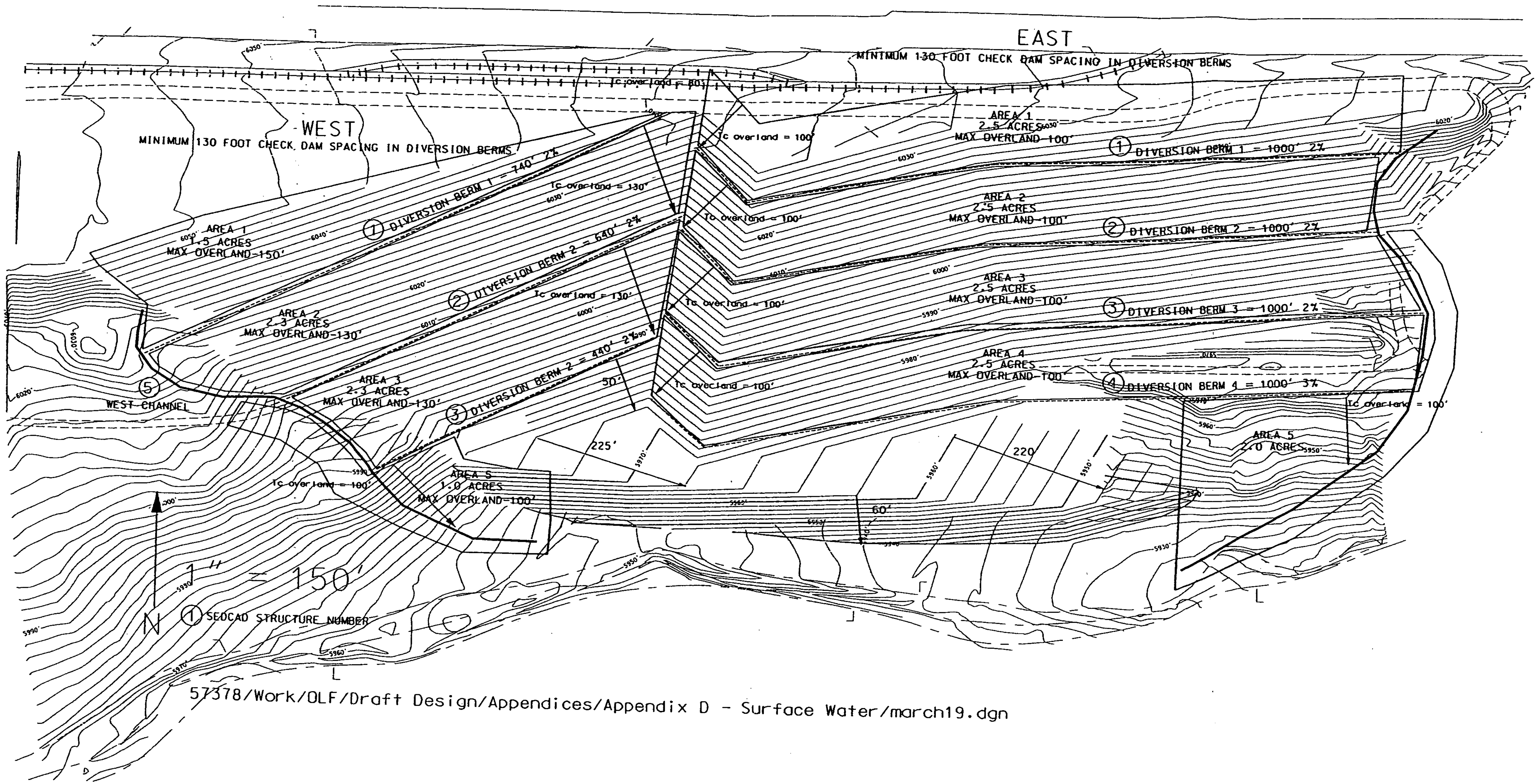

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APPENDIX D

ATTACHMENT 2
SEDCAD REPORTS

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RFETS

WEST CHANNEL SEDIMENT

Ryan Archibald

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WEST

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.460	0.018	0.000	0.000	86.000	M	1.47	0.072
	Σ	**0.460**						**1.47**	**0.072**
#2	Σ	**0.460**						**1.47**	**0.072**
#3	1	0.460	0.018	0.000	0.000	86.000	M	1.47	0.072
	Σ	**0.920**						**2.94**	**0.144**
#4	Σ	**0.920**						**2.94**	**0.144**
#5	1	0.460	0.018	0.000	0.000	86.000	M	1.47	0.072
	Σ	**1.380**						**4.41**	**0.216**
#6	Σ	**1.380**						**4.41**	**0.216**
#7	1	0.460	0.018	0.000	0.000	86.000	M	1.47	0.072
	Σ	**1.840**						**5.88**	**0.288**
#8	Σ	**1.840**						**5.88**	**0.288**
#9	1	0.460	0.018	0.000	0.000	86.000	M	1.47	0.072
	Σ	**2.300**						**7.35**	**0.360**
#10	Σ	**2.300**						**7.35**	**0.360**
#11	Σ	**2.300**						**7.35**	**0.360**

From Appendix C FROM NAG Cutsheets APP C

Subwatershed Sedimentology Detail:

SEDIMENT FROM 1 SUBWATERSHED

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.283	130.00	18.00	0.0700	0.9850	1	1.9	40,772	29.95	2.67
	Σ							**1.9**	**40,772**	**29.95**	**2.67**
#2	Σ							**1.9**	**40,772**	**29.95**	**2.67**
#3	1	0.283	130.00	18.00	0.0700	0.9850	1	1.9	40,772	29.95	2.67
	Σ							**2.0**	**22,515**	**15.33**	**1.36**
#4	Σ							**2.0**	**22,515**	**15.33**	**1.36**
#5	1	0.283	130.00	18.00	0.0700	0.9850	1	1.9	40,772	29.95	2.67
	Σ							**2.2**	**16,363**	**10.40**	**0.92**

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Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#6	Σ							**2.2**	**16,363**	**10.40**	**0.92**
#7	1	0.283	130.00	18.00	0.0700	0.9850	1	1.9	40,772	29.95	2.67
	Σ							**2.7**	**14,806**	**9.15**	**0.81**
#8	Σ							**2.7**	**14,806**	**9.15**	**0.81**
#9	1	0.283	130.00	18.00	0.0700	0.9850	1	1.9	40,772	29.95	2.67
	Σ							**3.0**	**13,202**	**7.87**	**0.69**
#10	Σ							**3.0**	**13,202**	**7.87**	**0.69**
#11	Σ							**3.0**	**13,202**	**7.87**	**0.69**

TOTAL SED w/o DAMS = 1.9(5) = 9.5 w/out check dams
TOTAL WITH DAMS = 3

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	18.00	23.40	130.00	3.390	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.60	130.00	4.240	0.008
#1	**1**	**Time of Concentration:**					**0.018**
#3	1	3. Short grass pasture	18.00	23.40	130.00	3.390	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.60	130.00	4.240	0.008
#3	**1**	**Time of Concentration:**					**0.018**
#5	1	3. Short grass pasture	18.00	23.40	130.00	3.390	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.60	130.00	4.240	0.008
#5	**1**	**Time of Concentration:**					**0.018**
#7	1	3. Short grass pasture	18.00	23.40	130.00	3.390	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.60	130.00	4.240	0.008
#7	**1**	**Time of Concentration:**					**0.018**
#9	1	3. Short grass pasture	18.00	23.40	130.00	3.390	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	2.60	130.00	4.240	0.008
#9	**1**	**Time of Concentration:**					**0.018**

RFETS-100 YEAR

WEST CHANNEL

Ryan Archibald

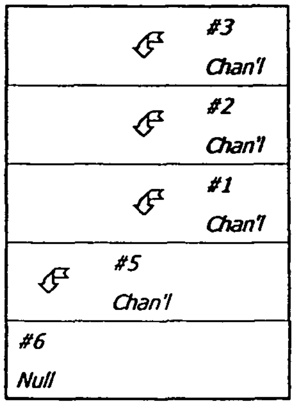
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	5.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#5	0.032	0.417	
Channel	#2	==>	#5	0.032	0.417	
Channel	#3	==>	#5	0.032	0.417	
Channel	#5	==>	#6	0.000	0.000	
Null	#6	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	8.00	80.00	1,000.00	8.48	0.032
#1	**Muskingum K:**					**0.032**
#2	8. Large gullies, diversions, and low flowing streams	8.00	80.00	1,000.00	8.48	0.032
#2	**Muskingum K:**					**0.032**
#3	8. Large gullies, diversions, and low flowing streams	8.00	80.00	1,000.00	8.48	0.032
#3	**Muskingum K:**					**0.032**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	1.700	1.700	9.76	0.49
#2	2.300	2.300	13.21	0.66
#1	1.500	1.500	8.61	0.43
#5	1.000	6.500	37.33	1.88
#6	0.000	6.500	37.33	1.88

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Structure Detail:

Structure #3 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	9.76 cfs		9.76 cfs	
Depth:	0.99 ft	1.99 ft	1.53 ft	2.53 ft
Top Width:	8.55 ft	17.15 ft	13.19 ft	21.79 ft
Velocity:	2.30 fps		0.96 fps	
X-Section Area:	4.25 sq ft		10.12 sq ft	
Hydraulic Radius:	0.484		0.747	
Froude Number:	0.57		0.19	
Roughness Coefficient:	0.0564		0.1796	

Structure #2 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	13.21 cfs		13.21 cfs	
Depth:	1.09 ft	2.09 ft	1.64 ft	2.64 ft
Top Width:	9.34 ft	17.94 ft	14.10 ft	22.70 ft

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Velocity:	2.60 fps		1.14 fps	
X-Section Area:	5.07 sq ft		11.57 sq ft	
Hydraulic Radius:	0.529		0.799	
Froude Number:	0.62		0.22	
Roughness Coefficient:	0.0529		0.1587	

Structure #1 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	8.61 cfs		8.61 cfs	
Depth:	0.96 ft	1.96 ft	1.49 ft	2.49 ft
Top Width:	8.24 ft	16.84 ft	12.83 ft	21.43 ft
Velocity:	2.18 fps		0.90 fps	
X-Section Area:	3.95 sq ft		9.57 sq ft	
Hydraulic Radius:	0.467		0.727	
Froude Number:	0.56		0.18	
Roughness Coefficient:	0.0580		0.1890	

Structure #5 (Nonerodible Channel)

Trapezoidal Nonerodible Channel Inputs:

Material: Plastic

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	12.0	0.0390	1.00		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	37.33 cfs	
Depth:	0.46 ft	1.46 ft
Top Width:	12.73 ft	18.73 ft
Velocity:	7.21 fps	
X-Section Area:	5.18 sq ft	
Hydraulic Radius:	0.402	
Froude Number:	1.99	

Structure #6 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	1.700	0.036	0.000	0.000	86.000	M	9.76	0.491
	Σ	**1.700**						**9.76**	**0.491**
#2	1	2.300	0.051	0.000	0.000	86.000	M	13.21	0.665
	Σ	**2.300**						**13.21**	**0.665**
#1	1	1.500	0.048	0.000	0.000	86.000	M	8.61	0.433
	Σ	**1.500**						**8.61**	**0.433**
#5	1	1.000	0.008	0.000	0.000	86.000	M	5.74	0.289
	Σ	**6.500**						**37.33**	**1.878**
#6	Σ	**6.500**						**37.33**	**1.878**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	2.00	14.79	739.50	4.240	0.048
#1	**1**	**Time of Concentration:**					**0.048**
#2	1	3. Short grass pasture	18.00	23.40	130.00	3.390	0.010
		8. Large gullies, diversions, and low flowing streams	2.00	12.79	639.50	4.240	0.041
#2	**1**	**Time of Concentration:**					**0.051**
#3	1	3. Short grass pasture	18.00	18.00	99.99	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	8.80	440.00	4.240	0.028
#3	**1**	**Time of Concentration:**					**0.036**
#5	1	3. Short grass pasture	18.00	18.00	99.99	3.390	0.008
#5	**1**	**Time of Concentration:**					**0.008**

RFETS-1000 YEAR

WEST CHANNEL

Ryan Archibald

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Structure Detail:

Structure #3 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	13.23 cfs		13.23 cfs	
Depth:	1.09 ft	2.09 ft	1.64 ft	2.64 ft
Top Width:	9.35 ft	17.95 ft	14.10 ft	22.70 ft
Velocity:	2.60 fps		1.14 fps	
X-Section Area:	5.08 sq ft		11.57 sq ft	
Hydraulic Radius:	0.529		0.799	
Froude Number:	0.62		0.22	
Roughness Coefficient:	0.0529		0.1585	

Structure #2 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	17.91 cfs		17.91 cfs	
Depth:	1.19 ft	2.19 ft	1.75 ft	2.75 ft
Top Width:	10.22 ft	18.82 ft	15.08 ft	23.68 ft

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	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Velocity:	2.95 fps		1.35 fps	
X-Section Area:	6.07 sq ft		13.23 sq ft	
Hydraulic Radius:	0.579		0.854	
Froude Number:	0.67		0.25	
Roughness Coefficient:	0.0495		0.1401	

Structure #1 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	11.68 cfs		11.68 cfs	
Depth:	1.05 ft	2.05 ft	1.60 ft	2.60 ft
Top Width:	9.01 ft	17.61 ft	13.73 ft	22.33 ft
Velocity:	2.47 fps		1.07 fps	
X-Section Area:	4.72 sq ft		10.95 sq ft	
Hydraulic Radius:	0.510		0.777	
Froude Number:	0.60		0.21	
Roughness Coefficient:	0.0543		0.1669	

Structure #5 (Nonerodible Channel)

Trapezoidal Nonerodible Channel Inputs:

Material: Plastic

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	12.0	0.0390	1.00		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	50.60 cfs	
Depth:	0.54 ft	1.54 ft
Top Width:	13.26 ft	19.26 ft
Velocity:	8.01 fps	
X-Section Area:	6.32 sq ft	
Hydraulic Radius:	0.470	
Froude Number:	2.04	

Structure #6 (Null)

RFETS

EAST CHANNEL SEDIMENT

Ryan Archibald

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EAST

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.500	0.021	0.000	0.000	86.000	M	1.60	0.078
	Σ	**0.500**						**1.60**	**0.078**
#2	Σ	**0.500**						**1.60**	**0.078**
#3	1	0.500	0.021	0.000	0.000	86.000	M	1.60	0.078
	Σ	**1.000**						**3.20**	**0.157**
#4	Σ	**1.000**						**3.20**	**0.157**
#5	1	0.500	0.021	0.000	0.000	86.000	M	1.60	0.078
	Σ	**1.500**						**4.80**	**0.235**
#6	Σ	**1.500**						**4.80**	**0.235**
#7	1	0.500	0.021	0.000	0.000	86.000	M	1.60	0.078
	Σ	**2.000**						**6.39**	**0.313**
#8	Σ	**2.000**						**6.39**	**0.313**
#9	1	0.500	0.021	0.000	0.000	86.000	M	1.60	0.078
	Σ	**2.500**						**7.99**	**0.391**
#10	Σ	**2.500**						**7.99**	**0.391**
#11	Σ	**2.500**						**7.99**	**0.391**

APP C NAG APPC SEDIMENT FROM 1 SUBWATERSHED

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.283	100.00	18.00	0.0700	0.9850	1	1.8	35,249	25.89	2.30
	Σ							**1.8**	**35,249**	**25.89**	**2.30**
#2	Σ							**1.8**	**35,249**	**25.89**	**2.30**
#3	1	0.283	100.00	18.00	0.0700	0.9850	1	1.8	35,249	25.89	2.30
	Σ							**1.9**	**19,446**	**13.24**	**1.17**
#4	Σ							**1.9**	**19,446**	**13.24**	**1.17**
#5	1	0.283	100.00	18.00	0.0700	0.9850	1	1.8	35,249	25.89	2.30

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Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							2.1	14,127	8.98	0.79
#6	Σ							2.1	14,127	8.98	0.79
#7	1	0.283	100.00	18.00	0.0700	0.9850	1	1.8	35,249	25.89	2.30
	Σ							2.6	13,250	8.27	0.73
#8	Σ							2.6	13,250	8.27	0.73
#9	1	0.283	100.00	18.00	0.0700	0.9850	1	1.8	35,249	25.89	2.30
	Σ							2.7	10,846	6.35	0.56
#10	Σ							2.7	10,846	6.35	0.56
#11	Σ							2.7	10,846	6.35	0.56

TOTAL SED W/O DAMS: 1.8(5) = 9 tons
TOTAL W/ DAMS: 2.7 tons

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	18.00	18.00	99.99	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#1	**1**	**Time of Concentration:**					**0.021**
#3	1	3. Short grass pasture	18.00	18.00	99.99	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#3	**1**	**Time of Concentration:**					**0.021**
#5	1	3. Short grass pasture	18.00	18.00	100.00	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#5	**1**	**Time of Concentration:**					**0.021**
#7	1	3. Short grass pasture	18.00	18.00	100.00	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#7	**1**	**Time of Concentration:**					**0.021**
#9	1	3. Short grass pasture	18.00	18.00	100.00	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	4.00	200.00	4.240	0.013
#9	**1**	**Time of Concentration:**					**0.021**

RFETS-100 YEAR

EAST CHANNEL

Ryan Archibald

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 24 hr
Rainfall Depth:	5.000 inches

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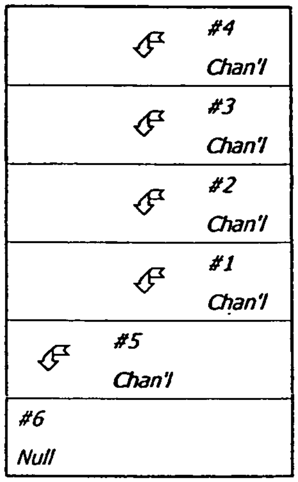
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#5	0.032	0.417	
Channel	#2	==>	#5	0.032	0.417	
Channel	#3	==>	#5	0.032	0.417	
Channel	#4	==>	#5	0.032	0.417	
Channel	#5	==>	#6	0.000	0.000	
Null	#6	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	8.00	80.00	1,000.00	8.48	0.032
#1	**Muskingum K:**					**0.032**
#2	8. Large gullies, diversions, and low flowing streams	8.00	80.00	1,000.00	8.48	0.032
#2	**Muskingum K:**					**0.032**
#3	8. Large gullies, diversions, and low flowing streams	8.00	80.00	1,000.00	8.48	0.032
#3	**Muskingum K:**					**0.032**
#4	8. Large gullies, diversions, and low flowing streams	8.00	80.00	1,000.00	8.48	0.032
#4	**Muskingum K:**					**0.032**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	2.500	2.500	14.36	0.72
#3	2.500	2.500	14.36	0.72
#2	2.500	2.500	14.36	0.72
#1	2.500	2.500	14.36	0.72
#5	1.000	11.000	63.18	3.18
#6	0.000	11.000	63.18	3.18

Structure Detail:

Structure #4 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	14.36 cfs		14.36 cfs	
Depth:	1.11 ft	2.11 ft	1.67 ft	2.67 ft
Top Width:	9.57 ft	18.17 ft	14.36 ft	22.96 ft
Velocity:	2.70 fps		1.20 fps	
X-Section Area:	5.33 sq ft		11.99 sq ft	
Hydraulic Radius:	0.542		0.813	
Froude Number:	0.64		0.23	
Roughness Coefficient:	0.0519		0.1533	

Structure #3 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	14.36 cfs		14.36 cfs	
Depth:	1.11 ft	2.11 ft	1.67 ft	2.67 ft
Top Width:	9.57 ft	18.17 ft	14.36 ft	22.96 ft

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	14.36 cfs		14.36 cfs	
Depth:	1.11 ft	2.11 ft	1.67 ft	2.67 ft
Top Width:	9.57 ft	18.17 ft	14.36 ft	22.96 ft
Velocity:	2.70 fps		1.20 fps	
X-Section Area:	5.33 sq ft		11.99 sq ft	
Hydraulic Radius:	0.542		0.813	
Froude Number:	0.64		0.23	
Roughness Coefficient:	0.0519		0.1533	

Structure #5 (Nonerodible Channel)

Trapezoidal Nonerodible Channel Inputs:

Material: Plastic

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
18.00	3.0:1	3.0:1	12.0	0.0390	1.00		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	63.18 cfs	
Depth:	0.44 ft	1.44 ft
Top Width:	20.67 ft	26.67 ft
Velocity:	7.34 fps	
X-Section Area:	8.60 sq ft	
Hydraulic Radius:	0.413	
Froude Number:	2.01	

Structure #6 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	2.500	0.073	0.000	0.000	86.000	M	14.36	0.722
	Σ	**2.500**						**14.36**	**0.722**
#3	1	2.500	0.073	0.000	0.000	86.000	M	14.36	0.722
	Σ	**2.500**						**14.36**	**0.722**
#2	1	2.500	0.073	0.000	0.000	86.000	M	14.36	0.722
	Σ	**2.500**						**14.36**	**0.722**
#1	1	2.500	0.073	0.000	0.000	86.000	M	14.36	0.722
	Σ	**2.500**						**14.36**	**0.722**
#5	1	1.000	0.008	0.000	0.000	86.000	M	5.74	0.289
	Σ	**11.000**						**63.18**	**3.178**
#6	Σ	**11.000**						**63.18**	**3.178**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	18.00	18.00	99.99	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	20.00	1,000.00	4.240	0.065
#1	**1**	**Time of Concentration:**					**0.073**
#2	1	3. Short grass pasture	18.00	18.00	100.00	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	20.00	1,000.00	4.240	0.065
#2	**1**	**Time of Concentration:**					**0.073**
#3	1	3. Short grass pasture	18.00	18.00	100.00	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	20.00	1,000.00	4.240	0.065
#3	**1**	**Time of Concentration:**					**0.073**
#4	1	3. Short grass pasture	18.00	18.00	100.00	3.390	0.008
		8. Large gullies, diversions, and low flowing streams	2.00	20.00	1,000.00	4.240	0.065
#4	**1**	**Time of Concentration:**					**0.073**
#5	1	3. Short grass pasture	18.00	18.00	99.99	3.390	0.008
#5	**1**	**Time of Concentration:**					**0.008**

RFETS-1000 YEAR

EAST CHANNEL

Ryan Archibald

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Structure Detail:

Structure #4 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.46 cfs		19.46 cfs	
Depth:	1.22 ft	2.22 ft	1.79 ft	2.79 ft
Top Width:	10.47 ft	19.07 ft	15.37 ft	23.97 ft
Velocity:	3.06 fps		1.42 fps	
X-Section Area:	6.37 sq ft		13.73 sq ft	
Hydraulic Radius:	0.593		0.870	
Froude Number:	0.69		0.26	
Roughness Coefficient:	0.0486		0.1354	

Structure #3 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.46 cfs		19.46 cfs	
Depth:	1.22 ft	2.22 ft	1.79 ft	2.79 ft
Top Width:	10.47 ft	19.07 ft	15.37 ft	23.97 ft

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Velocity:	3.06 fps		1.42 fps	
X-Section Area:	6.37 sq ft		13.73 sq ft	
Hydraulic Radius:	0.593		0.870	
Froude Number:	0.69		0.26	
Roughness Coefficient:	0.0486		0.1354	

Structure #2 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.46 cfs		19.46 cfs	
Depth:	1.22 ft	2.22 ft	1.79 ft	2.79 ft
Top Width:	10.47 ft	19.07 ft	15.37 ft	23.97 ft
Velocity:	3.06 fps		1.42 fps	
X-Section Area:	6.37 sq ft		13.73 sq ft	
Hydraulic Radius:	0.593		0.870	
Froude Number:	0.69		0.26	
Roughness Coefficient:	0.0486		0.1354	

Structure #1 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	1.00			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.46 cfs		19.46 cfs	
Depth:	1.22 ft	2.22 ft	1.79 ft	2.79 ft
Top Width:	10.47 ft	19.07 ft	15.37 ft	23.97 ft
Velocity:	3.06 fps		1.42 fps	
X-Section Area:	6.37 sq ft		13.73 sq ft	
Hydraulic Radius:	0.593		0.870	
Froude Number:	0.69		0.26	
Roughness Coefficient:	0.0486		0.1354	

Structure #5 (Nonerodible Channel)

Trapezoidal Nonerodible Channel Inputs:

Material: Plastic

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
18.00	3.0:1	3.0:1	12.0	0.0390	1.00		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	85.64 cfs	
Depth:	0.53 ft	1.53 ft
Top Width:	21.19 ft	27.19 ft
Velocity:	8.21 fps	
X-Section Area:	10.43 sq ft	
Hydraulic Radius:	0.488	
Froude Number:	2.06	

Structure #6 (Null)

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APPENDIX D

ATTACHMENT 3
NAG REPORTS

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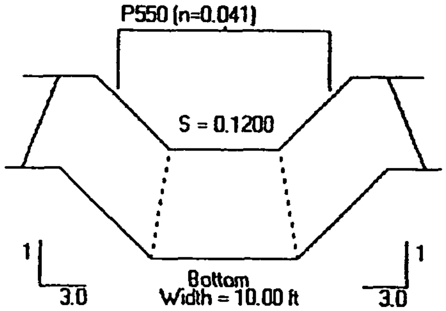
WEST CHANNEL

North American Green - ECMDS Version 4.2	3/23/200	04:53 PM	COMPUTED BY:
PROJECT NAME: RFETS-OLF	PROJECT NO.:		
FROM STATION/REACH: TO STATION/REACH:	DRAINAGE AREA:		DESIGN FREQUENCY:

HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
37.0	1.5	6.94	5.33	0.41	0.47



Not to Scale

BEND RESULTS

Bend Radius (ft)	Length Protection (ft)	Super Elevation Depth (ft)
105.0	5.2	0.7

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	P550	Unvegetated	1				3.50	3.50	1.00	STABLE
	Staple E									
Bend	P550	Unvegetated	1				3.50	3.50	1.00	STABLE
	Staple E									

EAST CHANNEL

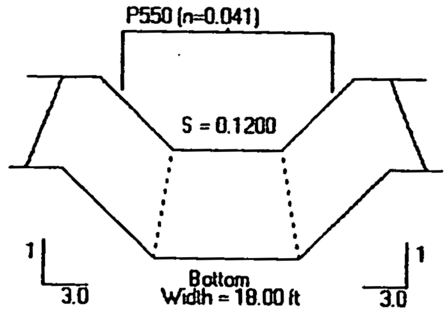
North American Green - ECMDS Version 4.2 | 3/23/200 | 04:54 PM | COMPUTED BY:

PROJECT NAME: RFETS-OLF | PROJECT NO.:

FROM STATION/REACH: | TO STATION/REACH: | DRAINAGE AREA: | DESIGN FREQUENCY:

HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
63.0	1.5	7.10	8.88	0.42	0.46



BEND RESULTS

Bend Radius (ft)	Length Protection (ft)	Super Elevation Depth (ft)
200.0	5.4	0.6

Not to Scale

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	P550	Unvegetated	1				3.50	3.43	1.02	STABLE
	Staple E									
Bend	P550	Unvegetated	1				3.50	3.43	1.02	STABLE
	Staple E									

DIVERSION BERMS

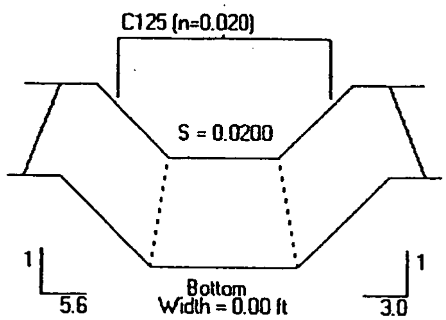
North American Green - ECMDS Version 4.2 | 3/23/200 | 04:57 PM | COMPUTED BY:

PROJECT NAME: RFETS-OLF | PROJECT NO.:

FROM STATION/REACH: | TO STATION/REACH: | DRAINAGE AREA: | DESIGN FREQUENCY:

HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
14.4	2.0	5.41	2.66	0.38	0.79



BEND RESULTS

Bend Radius (ft)	Length Protection (ft)	Super Elevation Depth (ft)
5.0	9.6	2.0

Not to Scale

LINER RESULTS

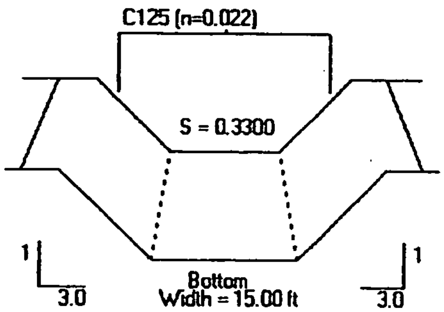
Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	C125	Unvegetated					2.25	0.98	2.29	STABLE
	Staple D									
Bend	C125	Unvegetated					2.25	0.98	2.29	STABLE
	Staple D									

DOWNSLOPE CHANNEL

North American Green - ECMDS Version 4.2		3/23/200 05:01 PM COMPUTED BY:	
PROJECT NAME: RFETS-OLF		PROJECT NO.:	
FROM STATION/REACH:	TO STATION/REACH:	DRAINAGE AREA:	DESIGN FREQUENCY:

HYDRAULIC RESULTS

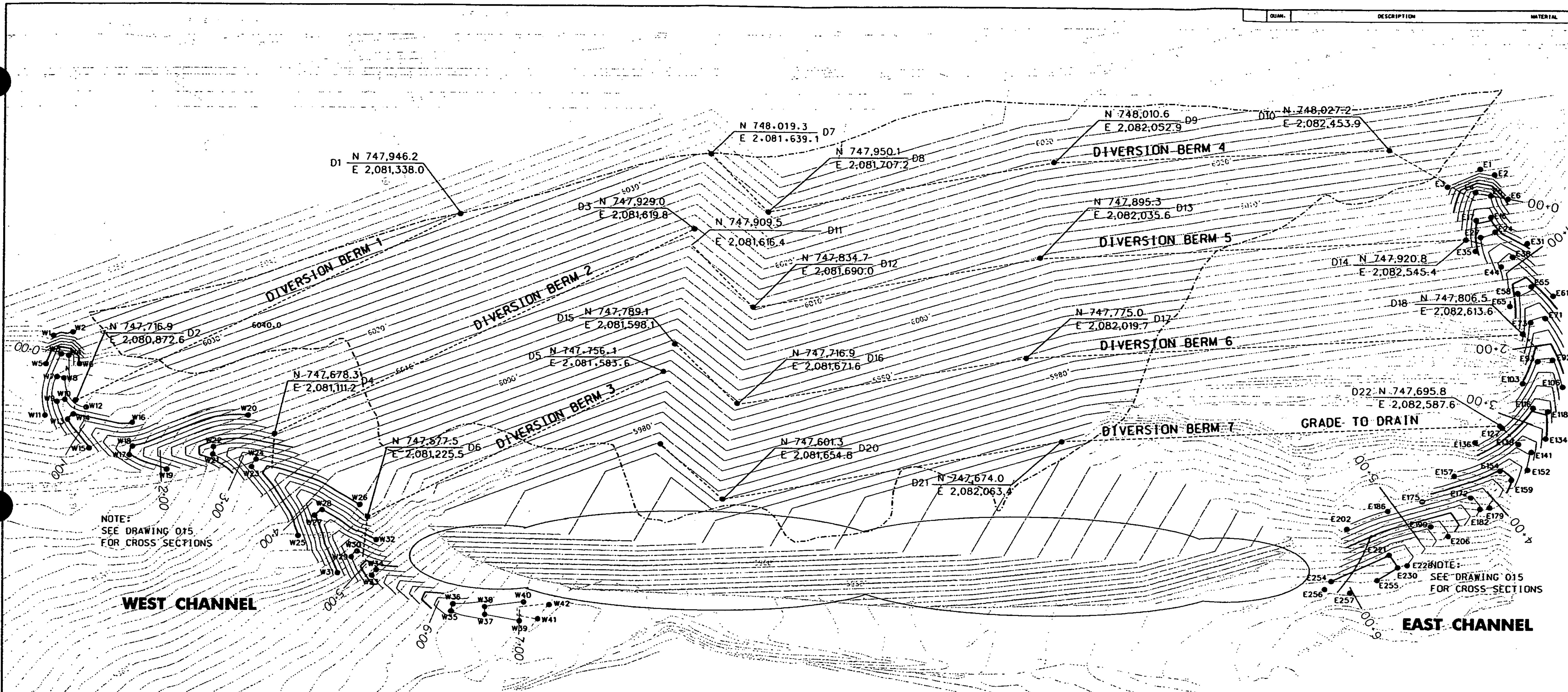
Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
14.4	2.0	8.68	1.66	0.11	0.11



Not to Scale

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	C125	Unvegetated					2.25	2.23	1.01	STABLE
	Staple D									



CONSTRUCTION CONTROL POINTS WEST CHANNEL			
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
W1	747796.3	2080845.4	6040.0
W2	747800.9	2080868.5	6040.0
W3	747774.9	2080854.6	6026.0
W4	747773.0	2080864.4	6026.0
W5	747763.4	2080837.0	6030.0
W6	747763.8	2080876.3	6030.0
W7	747746.8	2080849.2	6024.0
W8	747745.0	2080859.0	6024.0
W9	747716.2	2080850.2	6022.0
W10	747719.2	2080859.7	6022.0
W11	747699.8	2080835.7	6028.0
W12	747709.0	2080883.0	6024.0
W13	747694.6	2080863.1	6020.0
W14	747701.5	2080870.4	6020.0
W15	747660.2	2080889.2	6020.0
W16	747690.0	2080939.9	6020.0
W17	747652.7	2080937.7	6010.0
W18	747662.4	2080940.0	6010.0
W19	747634.7	2080982.9	6010.0
W20	747700.6	2081080.3	6010.0
W21	747652.2	2081038.4	5998.0

CONSTRUCTION CONTROL POINTS WEST CHANNEL			
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
W22	747662.2	2081038.8	5998.0
W23	747638.5	2081083.4	5992.0
W24	747647.1	2081088.4	5992.0
W25	747555.6	2081141.0	5990.0
W26	747592.2	2081215.8	5990.0
W27	747580.2	2081161.9	5980.0
W28	747586.7	2081169.5	5980.0
W29	747529.6	2081205.5	5972.0
W30	747536.5	2081212.8	5972.0
W31	747509.6	2081189.7	5980.0
W32	747549.7	2081237.0	5980.0
W33	747506.4	2081230.7	5968.0
W34	747514.6	2081236.4	5968.0
W35	747463.4	2081326.9	5956.0
W36	747473.1	2081329.4	5956.0
W37	747459.8	2081367.8	5954.0
W38	747469.8	2081368.0	5954.0
W39	747452.3	2081410.3	5954.0
W40	747475.7	2081415.9	5954.0
W41	747454.8	2081431.8	5952.0
W42	747472.9	2081446.2	5952.0

CONSTRUCTION CONTROL POINTS EAST CHANNEL			
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
E1	748005.4	2082561	6008.4
E2	747998.9	2082578.1	6006.8
E3	747983.6	2082521.7	6005.6
E4	747977.2	2082555.7	5994.1
E5	747973.9	2082573.4	5994.1
E6	747970	2082594.4	6001.2
E16	747947.7	2082574	5990.5
E17	747943.9	2082556.4	5990.5
E24	747929.8	2082578.9	5988.1
E27	747923.2	2082562.2	5988.1
E31	747915.9	2082617.8	5991.1
E35	747907	2082556.2	5991
E38	747900.2	2082600.3	5983.3
E44	747888.1	2082586.9	5983.3
E55	747864.6	2082622.7	5978.5
E58	747856.3	2082606.8	5978.5
E61	747853.2	2082648.5	5982.1
E65	747840.9	2082597.8	5982.3
E71	747826.4	2082639.1	5973.7
E73	747821	2082622	5973.7
E92	747775.2	2082648.6	5967.7
E93	747774.2	2082630.6	5967.7
E103	747747.2	2082613	5969.8
E106	747742.8	2082659.9	5968
E116	747717.4	2082625.4	5960.5

CONSTRUCTION CONTROL POINTS EAST CHANNEL			
POINT NUMBER	NORTH COORDINATE	EAST COORDINATE	DESIGN ELEVATION
E127	747692.6	2082589.1	5964.3
E134	747680.2	2082640.6	5959.6
E136	747675.4	2082557.4	5965.7
E138	747672.9	2082608.3	5954.5
E141	747664.4	2082624.2	5954.5
E152	747642.3	2082619.6	5954.6
E154	747641.3	2082587	5949.7
E157	747634.1	2082531.9	5954.5
E159	747629.8	2082600.9	5949.7
E172	747608.4	2082552	5943.7
E175	747603	2082494.5	5947.8
E179	747596.3	2082574.3	5946.6
E182	747594.3	2082563.2	5943.7
E186	747590.3	2082441.8	5948.7
E199	747572.6	2082504.4	5936.5
E202	747568.8	2082405.9	5946.7
E206	747561.2	2082525	5938.8
E221	747537.5	2082456.1	5930
E228	747525.3	2082477	5931.8
E230	747522.5	2082466.2	5930
E254	747505.2	2082387.9	
E255	747506.7	2082441.7	
E256	747495.4	2082380.1	
E257	747491.4	2082410.1	

CHANNEL ALIGNMENT (TO BE DETERMINED)
CHANNEL #1
CURVE #
START:
TC -
PI -
CT -
R -

LEGEND
------- DIVERSION BERM
● CONTROL POINT
-·-·-·- LIMIT OF WASTE
6+00 STATION NUMBER

N

0' 60 120'

FINAL COPY

ISSUE	DESCRIPTION	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
1	BUTRESS SIDESLOPE DIVERSION BERMS REMOVED PER ECR 002 (REVISION DESCRIPTION); EARTH TECH (DESIGN COMPANY)	5/19/05	RA	AS	RT	SL	RT				51378
0	ORIGINAL ISSUE										

PROJECT/WCF NO. 020525

KEYWORDS
1.
2.
3.
4.
5.

TOLERANCES FRACT. ± ANGLE ± DEC. ± UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES
NEXT ASSEMBLY
BLDG./FACILITY
ROOM/AREA
GRID COORD./COL NO.
SCALE: AS SHOWN

DESIGN COMPANY: EARTH TECH

DESIGNED BY		
R. ARCHIBALD	RA	5/12/05
DRAWN BY		
A. SKOTNIK	AS	5/12/05
CHECKED BY		
R. THOMPSON	RT	5/12/05
INDEPENDENT VERIFIER		
S. LAWRENCE	SL	5/12/05
APPROVED BY		
R. THOMPSON	RT	5/12/05
CLASSIFIER		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

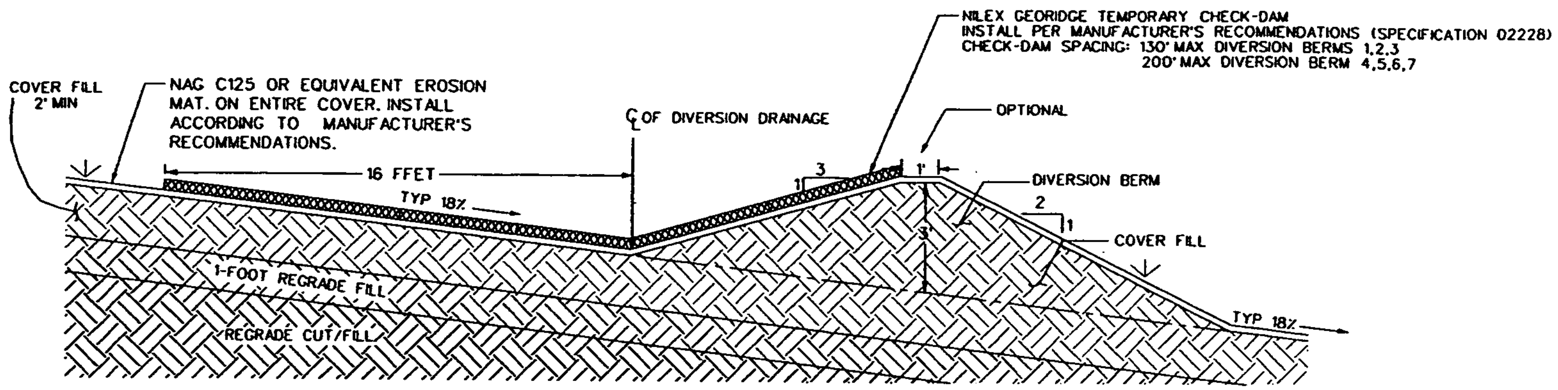
Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

DESIGN CHANNELS

ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-008	1

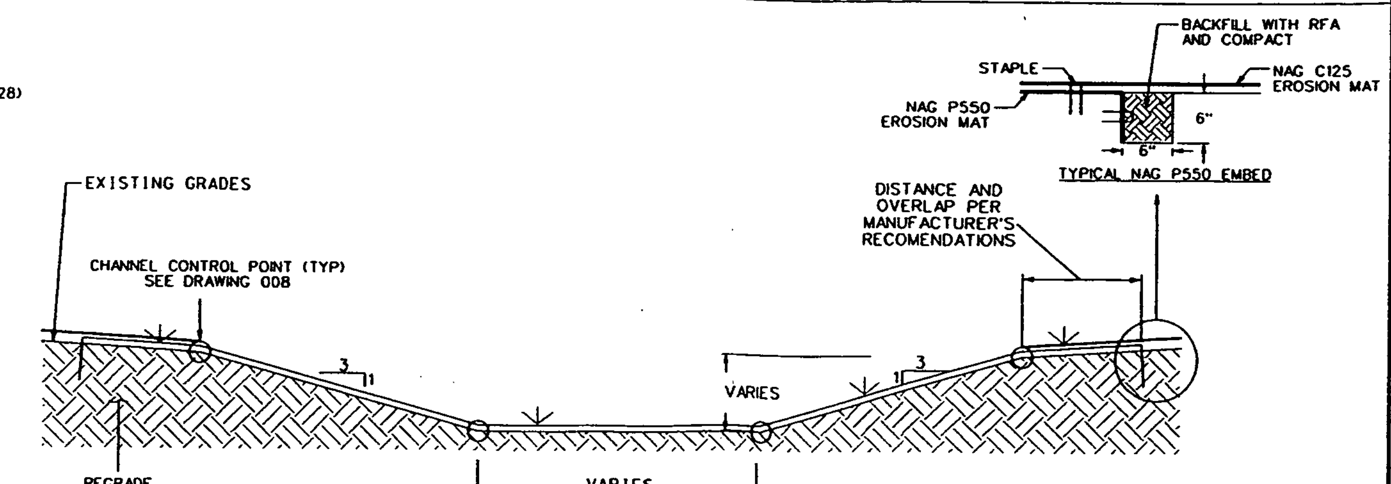
GROUP\CAD\ROCKY_FLATS\OLF_2005\SurfWater\Surf010rev.dgn Date: 5-19-2005



NOTE: IN AREAS OUTSIDE OF THE WASTE "FOOTPRINT" COVER SOIL MAY BE LESS THAN 2' (IN TRANSITION AREAS) OR NO COVER SOIL

DIVERSION BERM (SECTION) 1 9 12A

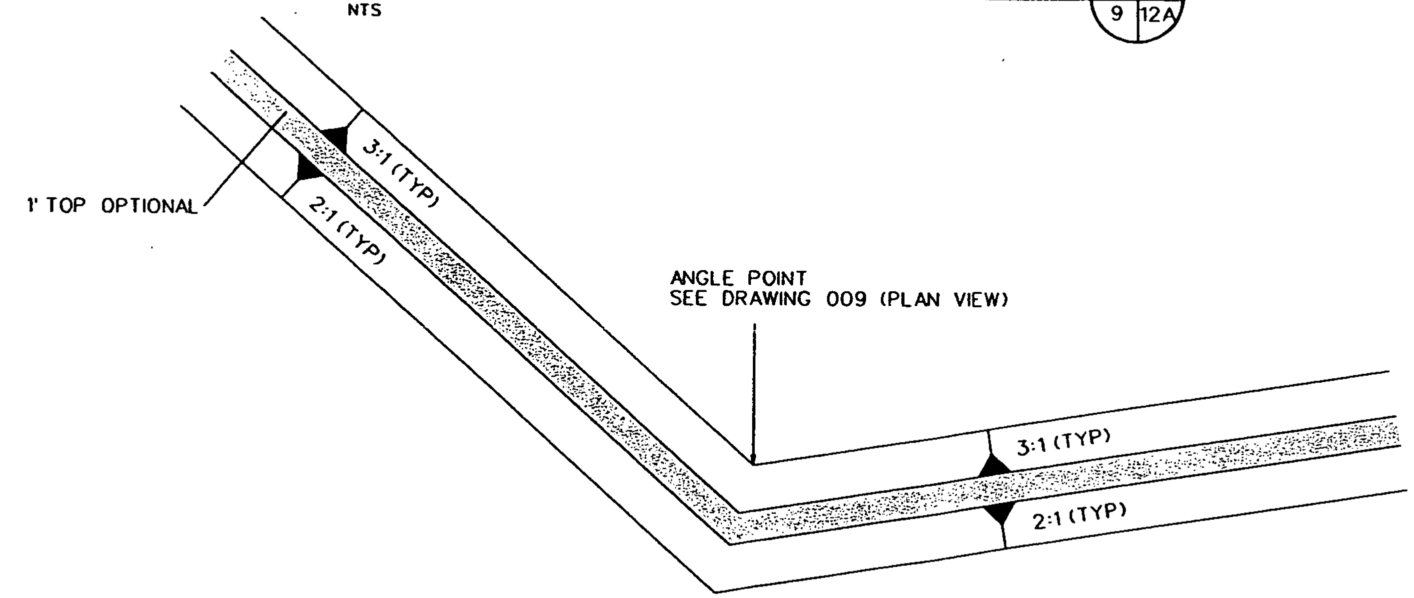
NTS



NOTE: NAG P550 OR EQUIVALENT EROSION MAT ON CHANNEL BOTTOM AND ALL SIDESLOPES. INSTALL ACCORDING TO MANUFACTURER'S RECCOMENDATIONS.

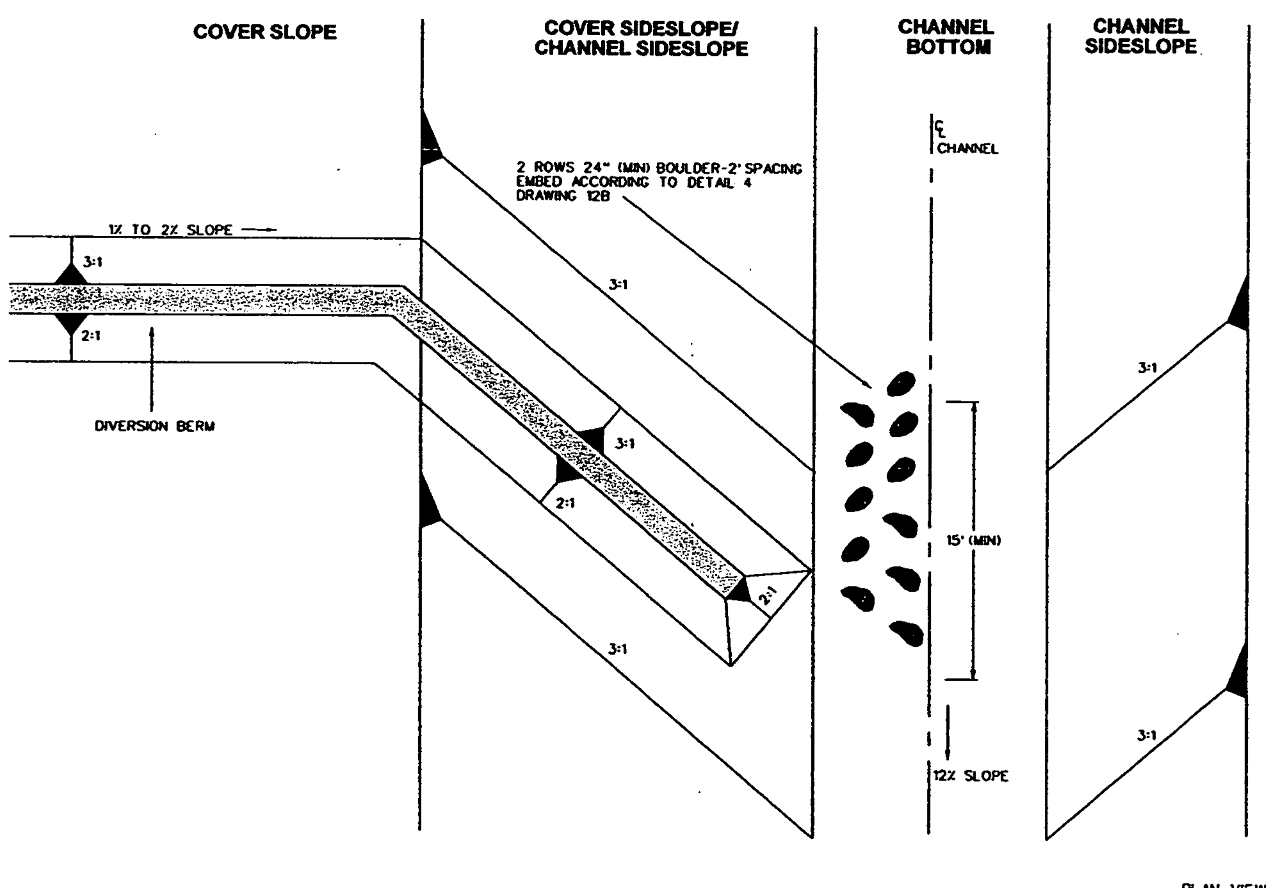
PERMANENT/GRASS LINED CHANNEL DETAIL (SECTION) 2 9 12A

NTS



DIVERSION BERM AT RIDGE LINE (PLAN VIEW) 4 9 12A

NTS



NOTE: NAG P550 OR EQUIVALENT EROSION MAT ON CHANNEL BOTTOM, CHANNEL SIDESLOPES, DOWNSLOPE CHANNEL BOTTOM, AND DOWNSLOPE CHANNEL SIDESLOPES. NAG C125 OR EQUIVALENT ON COVER SLOPE.

DOWNSLOPE CHANNEL TRANSITION FROM DIVERSION BERM TO CHANNEL (PLAN VIEW) 3 9 12A

NTS

FINAL COPY

ISSUE	DESCRIPTION								
1	DETAIL 5 REMOVED PER ECR 002 (REVISION DESCRIPTION)								
	EARTH TECH (DESIGN COMPANY)	5/19/05 (DATE)	RA (DSGN)	AS (DWN)	RT (CHKD)	SL (IV)	RT (APVD)	CLASS	57378 (PROJECT/CHARGE NO.)
0	ORIGINAL ISSUE (DESCRIPTION)								

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

KEYWORDS
1.
2.
3.
4.
5.

TOLERANCES
FRACT.
ANGLE
DEC.
UNLESS NOTED OTHERWISE
REMOVE BURRS AND SHARP EDGES

DESIGN COMPANY:
DESIGNED BY		
R. ARCHIBALD	RA	5/19/05
DRAWN BY		
A. SHOTNIK	AS	5/19/05
CHECKED BY		
R. THOMPSON	RT	5/19/05
INDEPENDENT VERIFIER		
S. LAWRENCE	SL	5/19/05
APPROVED BY		
R. THOMPSON	RT	5/19/05
CLASSIFIER		

BLDG./FACILITY: SITE
ROOM/AREA: NA
GRID COORD./COL. NO.: NA
NEXT ASSEMBLY: NA
SCALE: AS SHOWN

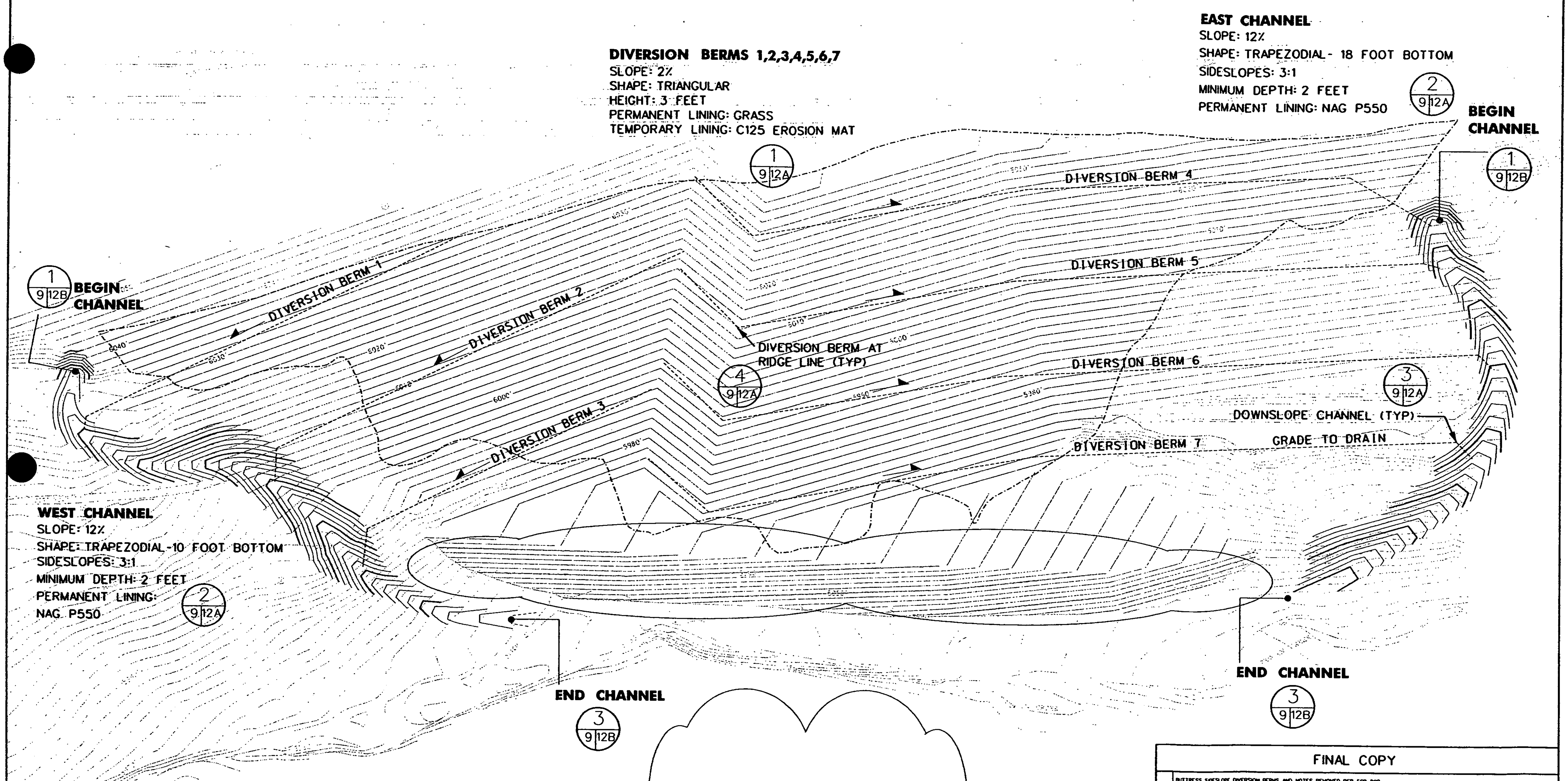
LANDFILL COVER DETAILS SURFACE WATER CONTROLS
ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-012A	1

L:\group\cad\rocky_flats\olf_2005\details\detairev.dgn 5/19/05

324

QUAN.	DESCRIPTION	MATERIAL



LEGEND

- DIVERSION BERM
- CHANNEL
- LIMIT OF WASTE

0' 60 120'

N

FINAL COPY

ISSUE	DESCRIPTION	DATE	DSGN	DWN	CHKD	IV	APVD			CLASS	PROJECT/CHARGE NO.
1	BUTTRESS SIDESLOPE DIVERSION BERMS AND NOTES REMOVED PER ECR 002 (REVISION DESCRIPTION); EARTH TECH (DESIGN COMPANY)	5/19/05	RA	AS	RT	SL	RT				57370
0	ORIGINAL ISSUE										

PROJECT/WCF NO. 020525

KEYWORDS	TOLERANCES	DESIGN COMPANY: EARTH TECH		
1.	FRACT. ±	DESIGNED BY		
2.	ANGLE ±	R. ARCHIBALD	RA	5/19/05
3.	DEC. ±	DRAWN BY		
4.	UNLESS NOTED OTHERWISE	A. SHOTNIK	AS	5/19/05
5.	REMOVE BURRS AND SHARP EDGES	CHECKED BY		
BLDG./FACILITY	NEXT ASSEMBLY	R. THOMPSON	RT	5/19/05
ROOM/AREA		INDEPENDENT VERIFIER		
GRID COORD./COL NO.	SCALE: AS SHOWN	S. LAWRENCE	SL	5/19/05
		APPROVED BY		
		R. THOMPSON	RT	5/19/05
		CLASSIFIER		

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

SURFACE WATER MANAGEMENT PLAN

ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-009	1

325

GROUP\CAD\ROCKY_FLATS\Olf_2005\SurfWater\SurfREV.dgn Date: 5-19-2005

ENGINEERING CHANGE REQUEST

PROJECT	**Cover Original Landfill**	ECR NO.	003
JOB NUMBER	**T0113090**	PAGE	1 OF 2
LOCATION	**RFETS**	ECR DATE	5/24/05
		REPLY DATE	5/25/05

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Buttress	LOCATION	Rocky Flats OLF
DRAWING NO.		SPEC. NO.	02221-0983

CHANGE REQUESTED

Change Buttress Fill Placement testing requirements as per attached page

REPLY REQUIRED BY 5/25/05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE

5/24/05
DATE

POTENTIAL IMPACT NOTICE
- __ SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST Cancelled

RM — 5/24/05 DATE

DM — for Randy Thompson — 5/25/05 DATE

CQAE — 5/26/05 DATE

Cancelled

CDPHE REPRESENTATIVE NA — DATE

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SPECIFICATION 02221-0983
Section 3.06 BUTTRESS FILL PLACEMENT

8. Where density testing is required by the Specifications, ~~either~~ nuclear density ~~meter, sand cone, or rubber balloon~~ test methods will be used for the field testing of the in-situ dry unit weight and moisture content of the in-place, compacted fill. One additonal nuclear density test (ASTM D 2922) will be performed by the QA team using a different nuclear density gage ~~sand cone test (ASTM D 1556) or rubber balloon test (ASTM D 2167)~~
and
one laboratory moisture content (ASTM D 2216) test will be conducted per 20 nuclear density tests (ASTM D 2922) to calibrate the results of the nuclear density meter. All nuclear density gages will be calibrated as per manufacturer's recommendations. If consistent calibration is demonstrated, frequencies may be reduced. Allowable moisture and dry density correlation deviation limits are presented in the Specifications. Any discrepancies between test results will be resolved by the QCSM and the Site Quality Assurance Manager (SQAM).

ENGINEERING CHANGE REQUEST

PROJECT	**Cover Original Landfill**	ECR NO.	005
JOB NUMBER	**T0113090**	PAGE	1 OF 1
LOCATION	**RFETS**	ECR DATE	5/18/2005
		REPLY DATE	5/19/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Drain Rock Thickness Acceptance	LOCATION	Rocky Flats OLF
DRAWING NO.	SPEC 02222	SPEC. NO.	

CHANGE REQUESTED
Insert into SPEC 02222 - Drain Rock PART 3 EXECUTION
3.02 DRAIN ROCK MATERIAL
C Measurement
The thickness of the drain rock layer shall be the average thickness of all the survey measurements with no single measurement less than 0.8-feet thick.

REPLY REQUIRED BY 6/10/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE DATE

POTENTIAL IMPACT NOTICE
__ SCHEDULE
X LABOR
__ MATERIAL
__ NO IMPACT
__ OTHER ____________

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST
This modification is approved. The average of all survey points will meet the 1-foot thick design with a tolerance at any individual point of -0.2 feet.

J. M. Keating
RM DATE 6/15/05

DM DATE 6/10/05

J. H. Rule
COAE DATE 6/15/05

Carl Spreng
CDPHE REPRESENTATIVE DATE 6/15/05

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ENGINEERING CHANGE REQUEST

PROJECT	Cover Original Landfill	ECR NO.	6
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	RFI DATE	6-14-05
		REPLY DATE	6-17-05

TO	Randy Thompson	COMPANY	Envirocon
SUBJECT	Drain Rock QA/QC	LOCATION	Original Landfill
DRAWING NO.		SPEC. NO.	0222

CHANGE REQUESTED

To remove LA abrasion, Sodium Sulfate Soundness, and Absorption testing from QC, and thusly QA testing requirements. QA/QC feel that testing is unnecessary and is based for other types of fill requirements, such as performance and durability not used in the original design of the Drain Rock

REPLY REQUIRED BY [signature] 6-17-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

[signature]
CONTRACTOR REP SIGNATURE

6-14-08
DATE

POTENTIAL IMPACT NOTICE

- __ SCHEDULE
- X LABOR
- __ MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

This is approved. Due to the limited exposure of the drain rock to abrasion and other environmental weathering conditions this testing is not required. Drain rock must continue to consist of Silica based crystalline material meeting the text description in specification 02222-0984 DRAIN ROCK, Part 2, section 2.01.A.1

J M Keating
RM

6/22/05
DATE

[signature]
DM

6/16/05
DATE

[signature] for John Rae
CQAE

6/17/05
DATE

Carl Spreng
CDPHE REPRESENTATIVE

6/20/05
DATE

ENGINEERING CHANGE REQUEST

PROJECT	Cover Original Landfill	ECR NO.	~~006~~ 007
JOB NUMBER	T0113090	PAGE	1 OF 7
LOCATION	RFETS	RFI DATE	6-17-05
		REPLY DATE	6-20-05

TO	RANDY THOMPSON	COMPANY	EMTR TECH
SUBJECT	DRAIN ROCK OUT OF SPEC.	LOCATION	ROCKY FLATS - OLF
DRAWING NO.	N/A	SPEC. NO.	02222-0984

CHANGE REQUESTED

DRAIN ROCK THAT HAS BEEN PLACED IS OUT OF SPECIFICATION IN ACCORDANCE WITH SECTION 2220-0984. REVIEW ATTACH DATA AND APPROVE USE.

REPLY REQUIRED BY 6-20-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE — DATE 6-17-05

POTENTIAL IMPACT NOTICE

- X SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ______

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

THE sampled drain rock is 10% high on weight of material passing the 3/8" sieve. However, the permeability that was assumed in the buttress subdrain calculations, K = 2,760 gal/day/ft². This is equivalent to K = 0.130 cm/s. The permeabilities of these two samples are 5.1 cm/s and 8.3 cm/s. Because these permeabilities are greater than an order of magnitude over the assumed worst-case permeability, and because these samples are from areas of drain rock with the greatest amount of fines, this material is acceptable.

[For compacted gravel, K = 2,760 gal/day/ft². This value was derived from Hydrologic and Physical Properties of Rock and Soil Materials as Analyzed by the Hydrologic Laboratory of the U.S.G.S., 1948-1960 USGS Water-Supply Paper 1839-D 1967. Site-specific materials testing supercedes literature values.

RM: M Keating	DATE 6/21/05
DM: for Randy Thompson	DATE 6/17/05
CQAE: J.H. Rala	DATE 6/23/05
CDPHE REPRESENTATIVE: Carl Spreng	DATE 6/22/05

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HYDROMETER DATA ENTRY SHEET

AS RECEIVED WATER CONTENT

Tare No.	
Wt. Wet Soil & Tare (gm)	
Wt. Dry Soil & Tare (gm)	
Wt. of Tare (gm)	
Wt. of Water (gm)	0.00
Weight of Dry Soil (gm)	0.00
Moisture Content (%)	--

MONTH AND YEAR	May-05
PROJECT NAME	Kaiser Hill/Rocky Flats Field & Lab
PROJECT NUMBER:	053-2203-0001
SAMPLE ID:	DR-4 Depth (ft) -
TYPE	Pail

Description: Brownish yellow (10 YR 6/6) poorly graded gravel

USCS: GP

HYGROSCOPIC MOISTURE FOR MINUS #4 SIEVE SAMPLE

Wt. Soil & Tare (gm)	179.36
Dry Soil & Tare (gm)	176.95
Tare Weight (gm)	24.76
Moisture Content (%)	1.6

LL	--	TEST BY	MKS
PL		DATE SET UP	6/13/2005
PI	--	REVIEW BY	MB

Total Weight of Sample Used For Sieve Analysis Corrected for Hydroscopic Moisture

Total Weight (gm): 26774.0

PLUS #4 MATERIAL SIEVE

Tare Weight: 0.00

Sieve	(Wt. + Tare)	Cumulative Wt. Retained	% RETAINED	% PASSING
12.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
3.0"	0.0	0.0	0.0	100.0
1.5"	549.2	549.2	2.1	97.9
1.0"	10958.6	11507.8	43.0	57.0
0.75"	7968.5	19476.3	72.7	27.3
0.375"	3534.4	23010.7	85.9	14.1
#4	712.5	23723.2	88.6	11.4
Total Passing #4	3099.1			

HYDROMETER ANALYSIS

Specific Gravity (ass'd)	2.7
Specific Gravity (tested)	
Amount Dispersing Agent (ml)	125.00
Type Dispersion Device	Mechanical
Length of Dispersion Period	1 Minute

cobbles	0.00	
coarse gravel	72.74	
fine gravel	15.86	88.61
coarse sand	1.24	
medium sand	2.78	
fine sand	2.91	6.93
fines	4.47	
	100.00	

WEIGHT OF SAMPLE USED FOR HYDROMETER TEST

Wt. of Sample Wet or Dry (gm): 50.4

BACK SIEVE

Tare Weight: 0.00

Sieve				% PASSING
#10	5.40	5.4	10.88	10.2
#20	11.54	11.5	23.26	8.7
#40	17.49	17.5	35.25	7.4
#60	22.00	22.0	44.34	6.3
#100	23.79	23.8	47.95	5.9
#200	30.17	30.2	60.81	4.5

DATE	TIME	READING R	TEMP T	HYD. COR. Cc
6/14/2005	10:10			
6/14/2005	10:12	21.0	20.60	5.50
6/14/2005	10:15	20.0	20.6	5.50
6/14/2005	10:25	19.0	20.7	5.50
6/14/2005	10:40	18.0	20.8	5.50
6/14/2005	11:10	17.3	20.6	5.50
6/14/2005	14:20	16.3	21.9	5.50
6/15/2005	10:10	15.3	21.1	5.50

(mm)	%Finer
0.035	3.52
0.022	3.30
0.013	3.07
0.009	2.84
0.007	2.67
0.003	2.44
0.001	2.22

!!!!!
2.7
6

WEIGHT OF SAMPLE USED FOR HYDROMETER TEST

Calculated Dry Wt. used in test (gm)	49.61
Hydrometer Bulb Number	624378
%Pass #4 Sieve for whole sample	11.3946

HYDROMETER CALCULATIONS

ET (min)	TEMP COR K	READING C	EFFECTIVE LENGTH	A
2.00	0.013446	15.50	13.8	0.99
5.00	0.013446	14.50	14	0.99
15.00	0.013446	13.50	14.2	0.99
30.00	0.013446	12.50	14.3	0.99
60.00	0.013446	11.75	14.5	0.99
250.00	0.013283	10.75	14.7	0.99
1440.00	0.013283	9.75	14.8	0.99

	X-AXIS	Y-AXIS
12.0"	304.800	100.0
6.0"	154.200	100.0
6.0"	154.200	100.0
6.0"	154.200	100.0
3.0"	75.000	100.0
1.5"	37.500	97.9
1.0"	25.000	57.0
0.75"	19.000	27.3
0.375"	9.500	14.1
#4	4.750	11.4
#10	2.000	10.2
#20	0.850	8.7
#40	0.425	7.4
#60	0.250	6.3
#100	0.150	5.9
#200	0.075	4.5
	0.0353	3.5
	0.0225	3.3
	0.0131	3.1
	0.0093	2.8
	0.0066	2.7
	0.0032	2.4
	0.0013	2.2

Check B: NG

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TABLE 2
KAISER HILL/ROCKY FLATS FIELD AND LAB
053-2203-0001
RIGID-WALL COMPRESSION
CONSTANT-HEAD PERMEABILITY
10-INCH DIAMETER CELL

Project Title:	Kaiser Hill/Rocky Flats Field and Lab	**Boring:**	
Project Number:	053-2203-0001	**Sample:**	DR-4
Date Tested:	6/13/05	**Depth:**	--

Sample Setup

Initial Sample Height, in	10.504
Mold Diameter, in	10.00
Sample Area, in^2	78.54
Wet Sample Weight, g	21,147.8
Wet Sample Weight, lb	46.63
Dry Sample Weight, g	21,083.7
Dry Sample Weight, lb	46.49

Initial Sample:
Moisture Determination

Tare	M32
Wet Weight and Tare, g	864.60
Dry Weight and Tare, g	862.30
Tare Weight, g	105.68
Moisture Content, %	0.3

Initial Sample Density and Void Ratio

Specific Gravity[1]	2.70
Initial Sample Volume, ft^3	0.477
Initial Wet Density, lb/ft^3	97.7
Initial Dry Density, lb/ft^3	97.4
Initial Void Ratio	0.73

Final Sample Density and Void Ratio

Final Sample Height, in	10.302
Final Sample Volume, ft^3	0.468
Final Dry Density, lb/ft^3	99.3
Final Void Ratio	0.70

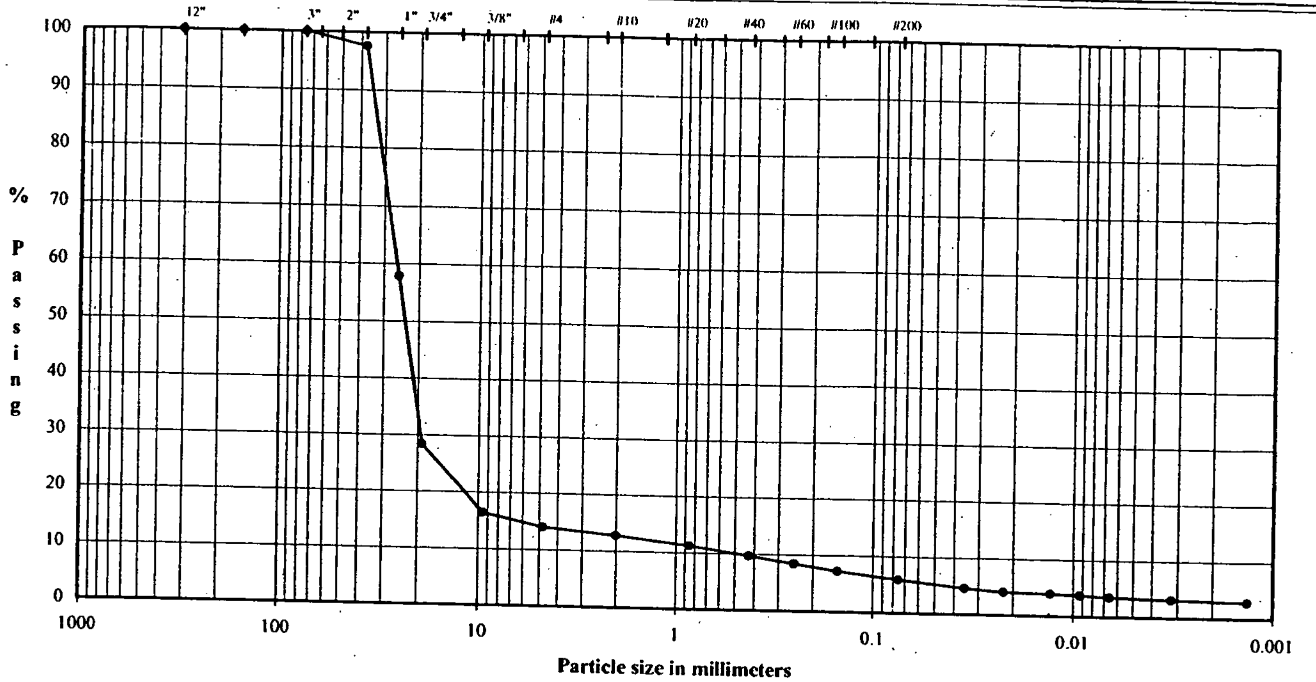
Load (psi)	Height (in)	Dry Density (pcf)	Void Ratio	Flow Rate (ml/sec)	Gradient	Permeability (cm/sec)	Porosity
26	10.302	99.3	0.70	34.62	0.01	5.1E+00	0.41

NOTES: [1]Specific Gravity = Assumed Value

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: DR-3
TYPE: Pail
Depth (ft): -



	Coarse	Fine	Coarse	Medium	Fine	
COBBLES	GRAVEL		SAND			Silt or Clay FINES

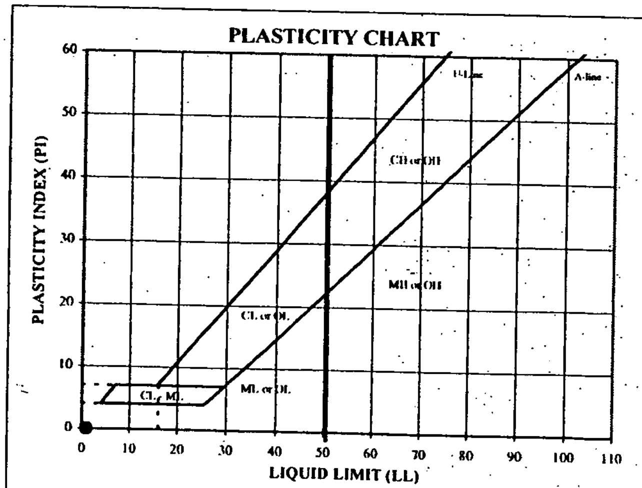
U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0	Coarse Gravel	71.61
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	97.6		
1.0"	25.0	57.8		
0.75"	19.0	28.4		
0.375"	9.5	16.4	Fine Gravel	14.39
#4	4.8	14.0		
#10	2.00	12.8	Coarse Sand	1.23
#20	0.85	11.2	Medium Sand	3.14
#40	0.43	9.6		
#60	0.25	8.4	Fine Sand	3.75
#100	0.15	7.2		
#200	0.075	5.9		

Hydrometer Analysis

(mm)	%Finer		
0.035	4.6	Fines Silt or Clay	5.88
0.022	4.1		
0.013	3.9		
0.0093	3.7		
0.0066	3.4		
0.0032	3.2		
0.0013	2.9		

PLASTICITY CHART



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
—	—	—	—	—

DESCRIPTION: Brownish yellow (10 YR 6/6) poorly graded gravel

USCS: GP

TECH	MKS
DATE	6/13/2005
REVIEW	MB

HYDROMETER DATA ENTRY SHEET

AS RECEIVED WATER CONTENT

Tare No.	
Wt. Wet Soil & Tare (gm)	
Wt. Dry Soil & Tare (gm)	
Wt. of Tare (gm)	
Wt. of Water (gm)	0.00
Weight of Dry Soil (gm)	0.00
Moisture Content (%)	–

MONTH AND YEAR	June-05
PROJECT NAME	Kaiser Hill/Rocky Flats Field & Lab
PROJECT NUMBER:	053-2203-0001
SAMPLE ID:	DR-3 Depth (ft) -
TYPE	Pail

Description: Brownish yellow (10 YR 6/6) poorly graded gravel

USCS: GP

HYGROSCOPIC MOISTURE FOR MINUS #4 SIEVE SAMPLE

Wt. Soil & Tare (gm)	184.86
Dry Soil & Tare (gm)	182.37
Tare Weight (gm)	28.07
Moisture Content (%)	1.6

LL	–
PL	–
PI	–

TEST BY	MKS
DATE SET UP	6/13/2005
REVIEW BY	MB

Total Weight of Sample Used For Sieve Analysis Corrected for Hydroscopic Moisture

Total Weight (gm): 27254.7

PLUS #4 MATERIAL SIEVE

Tare Weight: 0.00

Sieve	(Wt. + Tare)	Cumulative Wt. Retained	% RETAINED	% PASSING
12.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
6.0"	0.0	0.0	0.0	100.0
3.0"	0.0	0.0	0.0	100.0
1.5"	648.4	648.4	2.4	97.6
1.0"	10846.2	11494.6	42.2	57.8
0.75"	8022.4	19517.0	71.6	28.4
0.375"	3272.3	22789.3	83.6	16.4
#4	648.6	23437.9	86.0	14.0
Total Passing #4	3878.4			

BACK SIEVE

Tare Weight: 0.00

Sieve				% PASSING
#10	4.43	4.4	8.82	12.8
#20	9.90	9.9	19.70	11.2
#40	15.68	15.7	31.20	9.6
#60	20.15	20.2	40.10	8.4
#100	24.37	24.4	48.50	7.2
#200	29.15	29.2	58.01	5.9

HYDROMETER ANALYSIS

Specific Gravity (ass'd)	2.7
Specific Gravity (tested)	
Amount Dispersing Agent (ml)	125.00
Type Dispersion Device	Mechanical
Length of Dispersion Period	1 Minute

cobbles	0.00	
coarse gravel	71.61	
fine gravel	14.39	86.00
coarse sand	1.23	
medium sand	3.14	
fine sand	3.75	8.12
fines	5.88	
		100.00

WEIGHT OF SAMPLE USED FOR HYDROMETER TEST

Wt. of Sample Wet or Dry (gm): 51.06

DATE	TIME	READING R	TEMP T	HYD. COR. Cc
6/14/2005	10:14			
6/14/2005	10:16	22.3	20.80	5.50
6/14/2005	10:19	20.3	20.7	5.50
6/14/2005	10:29	19.8	20.8	5.50
6/14/2005	10:44	19.0	20.8	5.50
6/14/2005	11:14	18.0	20.7	5.50
6/14/2005	14:24	17.0	21.9	5.50
6/15/2005	10:14	16.0	21.2	5.50

(mm)	%Finer
0.035	4.62
0.022	4.07
0.013	3.93
0.009	3.72
0.007	3.45
0.003	3.17
0.001	2.90

!!!!
2.7
6

WEIGHT OF SAMPLE USED FOR HYDROMETER TEST

Calculated Dry Wt. used in test (gm)	50.25
Hydrometer Bulb Number	624378
%Pass #4 Sieve for whole sample	14.0042

HYDROMETER CALCULATIONS

ET (min)	TEMP COR. K	READING C	EFFECTIVE LENGTH	A
2.00	0.013446	16.75	13.7	0.99
5.00	0.013446	14.75	14	0.99
15.00	0.013446	14.25	14	0.99
30.00	0.013446	13.50	14.2	0.99
60.00	0.013446	12.50	14.3	0.99
250.00	0.013283	11.50	14.5	0.99
1440.00	0.013283	10.50	14.7	0.99

	X-AXIS	Y-AXIS
12.0"	304.800	100.0
6.0"	154.200	100.0
6.0"	154.200	100.0
6.0"	154.200	100.0
3.0"	75.000	100.0
1.5"	37.500	97.6
1.0"	25.000	57.8
0.75"	19.000	28.4
0.375"	9.500	16.4
#4	4.750	14.0
#10	2.000	12.8
#20	0.850	11.2
#40	0.425	9.6
#60	0.250	8.4
#100	0.150	7.2
#200	0.075	5.9
	0.0352	4.6
	0.0225	4.1
	0.0130	3.9
	0.0093	3.7
	0.0066	3.4
	0.0032	3.2
	0.0013	2.9

Check By: NG

TABLE 1
KAISER HILL/ROCKY FLATS FIELD AND LAB
053-2203-0001
RIGID-WALL COMPRESSION
CONSTANT-HEAD PERMEABILITY
10-INCH DIAMETER CELL

Project Title: Kaiser Hill/Rocky Flats Field and Lab
Project Number: 053-2203-0001
Date Tested: 6/13/05

Boring:
Sample: DR-3
Depth: –

Sample Setup

Initial Sample Height, in	10.6292
Mold Diameter, in	10.00
Sample Area, in^2	78.54
Wet Sample Weight, g	21,745.2
Wet Sample Weight, lb	47.95
Dry Sample Weight, g	21,667.1
Dry Sample Weight, lb	47.78

Initial Sample:
Moisture Determination

Tare	M93
Wet Weight and Tare, g	854.20
Dry Weight and Tare, g	851.50
Tare Weight, g	102.20
Moisture Content, %	0.4

Initial Sample Density and Void Ratio

Specific Gravity[1]	2.70
Initial Sample Volume, ft^3	0.483
Initial Wet Density, lb/ft^3	99.2
Initial Dry Density, lb/ft^3	98.9
Initial Void Ratio	0.70

Final Sample Density and Void Ratio

Final Sample Height, in	10.378
Final Sample Volume, ft^3	0.472
Final Dry Density, lb/ft^3	101.3
Final Void Ratio	0.66

Load (psi)	Height (in)	Dry Density (pcf)	Void Ratio	Flow Rate (ml/sec)	Gradient	Permeability (cm/sec)	Porosity
26	10.378	101.3	0.66	51.48	0.01	8.3E+00	0.40

NOTES: [1]Specific Gravity = Assumed Value

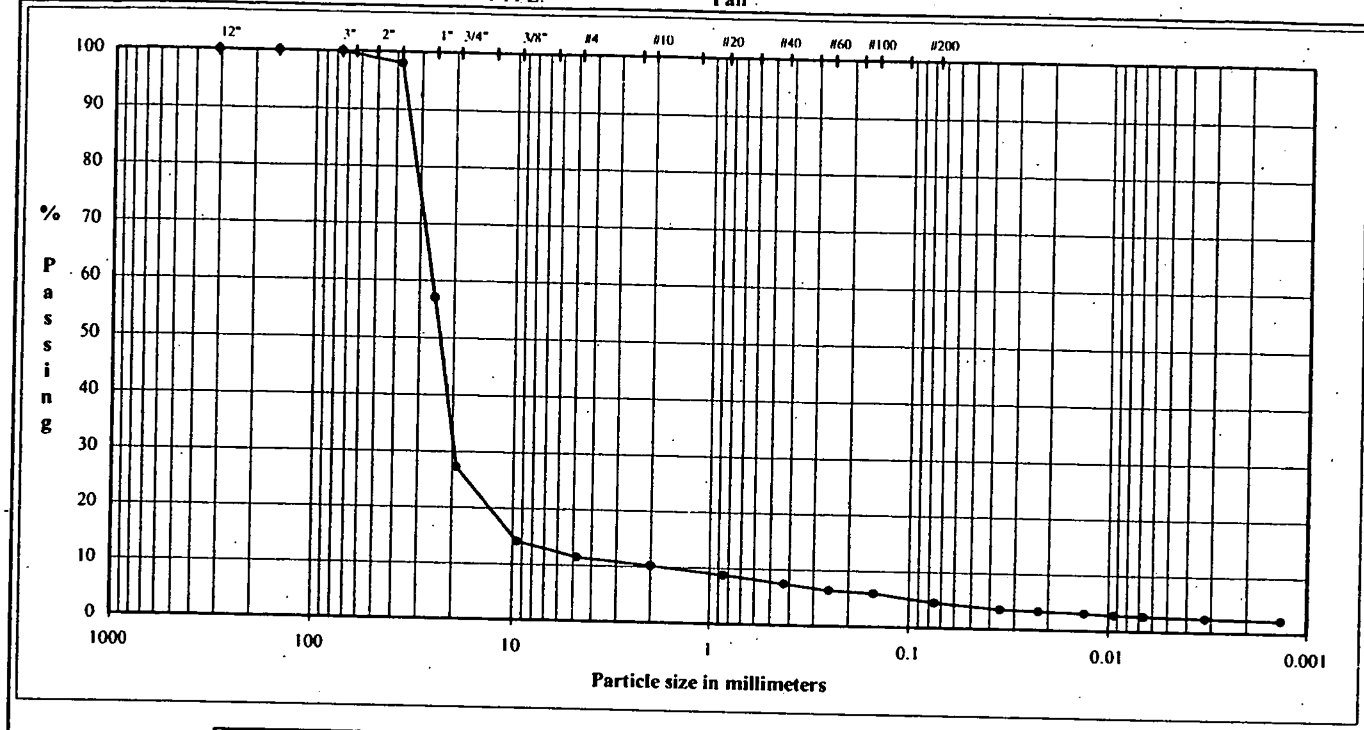
May-05

053-2203-0001

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: Kaiser Hill/Rocky Flats Field & Lab
SAMPLE ID: DR-4
TYPE: Pail

Depth (ft): -



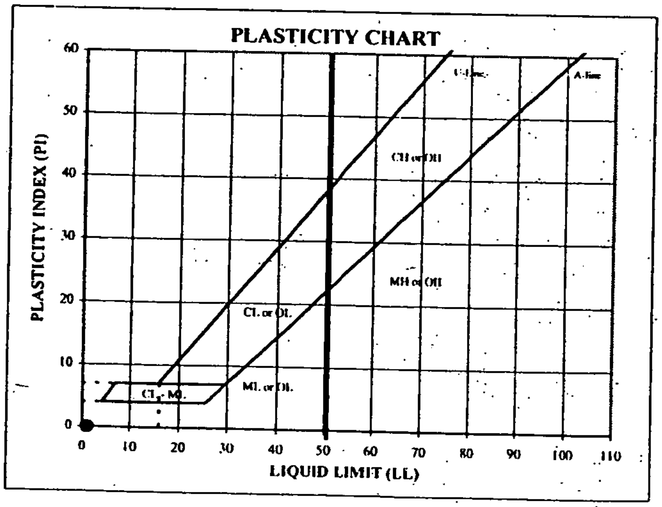
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
6.0"	154.2	100.0	Cobbles	0.00
6.0"	154.2	100.0		
6.0"	154.2	100.0		
3.0"	75.0	100.0		
1.5"	37.5	97.9		
1.0"	25.0	57.0	Coarse Gravel	72.74
0.75"	19.0	27.3		
0.375"	9.5	14.1		
#4	4.8	11.4	Fine Gravel	15.86
#10	2.00	10.2	Coarse Sand	1.24
#20	0.85	8.7		
#40	0.43	7.4	Medium Sand	2.78
#60	0.25	6.3		
#100	0.15	5.9		
#200	0.075	4.5	Fine Sand	2.91

Hydrometer Analysis

(mm)	%Finer		
0.035	3.5		
0.022	3.3		
0.013	3.1		
0.0093	2.8	Fines Silt or Clay	4.47
0.0066	2.7		
0.0032	2.4		
0.0013	2.2		



ATTERBERG LIMITS

M_c	LL	PL	PI	SpG
--	--	--	--	--

DESCRIPTION: Brownish yellow (10 YR 6/6) poorly graded gravel

USCS: GP

TECH	MKS
DATE	6/13/2005
REVIEW	MB

ENGINEERING CHANGE REQUEST

PROJECT	**Cover Original Landfill**	ECR NO.	008
JOB NUMBER	**T0113090**	PAGE	1 OF 2
LOCATION	**RFETS**	ECR DATE	6/22/2005
		REPLY DATE	6/23/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Revegetation	LOCATION	Rocky Flats OLF
DRAWING NO.	012A	SPEC. NO.	02900

CHANGE REQUESTED

Replace erosion mat (NAG C125) with FlexTerra hydromulch erosion in disturbed soil areas outside of diversion berms and channels. The NAG C125 and Nilex geobridge will be installed in the diversion berms as shown on Section 1 and NAG P550 will be installed in the Channel as shown on Section 2.

REPLY REQUIRED BY 6/23/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE

DATE

POTENTIAL IMPACT NOTICE

__ SCHEDULE
X LABOR
X MATERIAL
__ NO IMPACT
__ OTHER ___.________

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

RM J M Keating DATE 7/13/05

DM DATE 7/13/05

COAE J.H. Rale DATE 7/13/05

CDPHE REPRESENTATIVE Carl Sprong DATE 7/13/05

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Original Landfill Accelerated Action

Design Specifications Division 2

SPEC-02900-0990
SEEDING

Revised 7/7/05

Revised as per Norm Comment

APPROVED	APPROVED AS CORRECTED
NOT APPROVED	REVISE AND SUBMIT

APPROVAL IS FOR CONFORMANCE TO THE SITE DESIGN PROCESS AND WITH THE DESIGN CONCEPT OF THE CALCULATIONS, PLANS, AND SPECIFICATIONS.

PROJECT CHIEF ENGINEER DATE

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SPEC-02900-0990
SEEDING

PART 1 GENERAL

1.01 SUMMARY

A. The vegetation requirements for seeding shall be as described in the plans referenced below. All activities performed by the SUBCONTRACTOR shall be in accordance with all applicable Federal, State, and local laws and regulations.

1.02 REFERENCES

A. The following publications listed below form a part of the Specification to the extent referenced. The publications are referenced in the text by basic designation only. The most recent version of the referenced test methods shall be used in all cases.

1. American Society for Testing and Materials

   a. ASTM D 2974 Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

2. U.S. Department of Agriculture Federal Seed Act of 9 August 1939 (55 Stat. 1275)

3. The RFETS Revegetation Plan (Jan 2004, Rev 2)

1.03 SUBMITTALS

A. The SUBCONTRACTOR will prepare the following submittals for review by the CONTRACTOR and the QCSM in accordance with Section 01305 SUBMITTAL PROCEDURES:

1. Manufacturer's Catalog Data:

   Manufacturer's standard catalog data giving the brand names and catalog numbers of erosion control materials, in sufficient detail to demonstrate complete compliance with this section.

2. Manufacturer's Instructions:

   The manufacturer's installation instructions and procedures.

3. Approval of Materials:

   Material sources and material test results prior to field use.

4. Certified copy of seed analysis.

5. Seed bag tickets.

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1.04 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

A. The SUBCONTRACTOR shall abide by all qualification and submittal requirements of the QA/QC Plan and the Work Control Document(s) (WCD).

B. The work will be monitored and tested at the appropriate frequencies in accordance with the requirements of the approved QA/QC Plan.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery

Material used for seeding, such as seed, fertilizer, ~~hay~~straw, ~~hay~~ straw bales, blankets, etc., shall be inspected upon arrival at the job site.

B. Storage

Seed shall be protected from any drying, moisture or contamination by detrimental material upon delivery and when being stored.

PART 2 PRODUCTS

2.01 SEED

A. The pure live seed (PLS) mixture to be used shall be as follows:

1. Seed Mixture:

a. The seed is to be ordered as PLS.

b. The seed must be certified weed-free.

c. Seed is to be ordered and bagged separately by species (i.e., the seed company should deliver all the seed in separate bags by species). This allows Site ecologists to examine the seed for purity prior to seeding.

d. Seed bag tags will be pulled off the bags and provided to the CONTRACTOR.

B. ~~See Attachment for additional information~~Seed mix (Note: Because the seed will be hand-broadcast, this seed mix is double the RFETS revegetation application rate for hillside slope areas):

Species	Lbs PLS / acre
Thickspike wheatgrass, Critana	1.46
Western wheatgrass, Arriba	8.34
Slender wheatgrass, San Luis	5.44
Sideoats grama, Vaugn	2.98
Blue grama, Hachita	1.48
Buffalo Grass, Texoka	9.68
Green needle, Lodorm	2.42
Total lbs PLS per acre	31.8

2.02 NUTRIENT AMENDED SOIL/TOPSOIL

A. ~~As per the RFETS Revegetation Plan (January 2004 revision 2) RFETS Revegetation Plan.~~Nutrients may be added to the FlexTerra as per manufactures recommendation.

~~B. See Attachment for additional information.~~

2.03 SOIL EROSION CONTROL MATERIAL AND STAPLES

A. Erosion control materials shall conform to Section 02228 EROSION CONTROL

1. Synthetic Erosion Control Materials shall be North American Green C350 and P550 or equivalent.

2. ~~Silt Control Fence~~Degradable Erosion mat shall be North American Green C125 N~~D~~BN, or eqivalent.

3. ~~3.~~ Straw for crimping shall be certified as weed and pest free according to the Colorado Weed Free Forage Act.~~Bales~~

4. Fiber ~~F~~filtration ~~T~~tube shall be Terra-Tubes® TT965P as manufactured by Profile Products, LLC (or similar) and shall conform to the following property values:

Property	Test Method	~~English~~Value
Tube Diameter	Measured	9 in
Mass/Unit Length	Measured	1.0 lb/ft

5. The ~~F~~flexible ~~G~~growth ~~M~~medium™ (FGM™) shall be a hydraulically-applied, flexible erosion control blanket composed of long strand, thermally processed wood fibers, crimped, interlocking fibers and performance enhancing additives. The FGM requires no curing period and upon application forms an intimate bond with the soil surface to create a continuous, porous, absorbent and erosion resistant blanket that allows for rapid germination and accelerated plant growth.

The FGM shall be Flexterra (or equivalent)™~~, as manufactured by Profile Products, LLC~~ and shall ~~conform to an~~ be applied at a rate of 2,500 to 3,500 pounds per acre~~ (3900 kilograms/hectare)~~.

PART 3 EXECUTION

3.01 SEEDING AND EROSION CONTROL

A. General Erosion Control (Top of landfill and buttress): This section applies to areas of the landfill where permanent and degradable erosion mate~~control~~ is not required, namely the top of the landfill (outside the diversion berms) and the top of the buttress. Seeding and erosion control will take place per the current RFETS Revegetation Plan with the following modifications:

1) Humic bottom alluvium (excavated from the buttress area) will be incorporated into the RFA cover soil as per Buckner memo.

2) The RFA cover soil will be disced or ripped as needed to ~~minimize~~ compensate for over-compaction due to construction equipment traffic.

3) Straw crimping will be implemented in all areas not covered by erosion matting (C125BN, P550, or C350). Crimping will be performed ~~along slope contour lines~~first perpendicular to the slope, and then cross-slope (along contour lines).

4) Broadcast seed prior to straw crimping.

5) Flexterra spray-on flexible growth medium (or equivalent) will be applied at a rate of approximately 2,500 to 3,000 lbs/acre to all seeded areas in accordance with manufacturers instructions to provide a seedbed for germination.

6) After seeding and application of erosion protection, no vehicles or equipment will be allowed on the cover without specific authorization from the RM.

~~A.~~B. Permanent Erosion Control (~~Diversion berms,~~ channels, and buttress sideslope): ~~Seeding will take place per the current RFETS Revegetation Plan. Seeding of the channels, diversion berms, and buttress sideslope where vegetation is required for permanent erosion control will be seeded with the following additional steps:~~

1) The bottom area of the channel~~area~~ will be ripped or disced as needed to enhance seed growth.
2) The RFA will be placed on the south face of the buttress fill and graded with a D6 LGP or similar equipment to minimize overcompaction.

~~2)~~3) Approximately ~~minimum of~~ 2-inches of bottom alluvium (excavated from buttress area) will be placed on the surface of the Rocky Flats alluvium in the following critical erosion areas: in the- bottom of the channels and on the buttress sideslope. This bottom alluvium will be placed prior to installing P550 or C350 erosion matting.

~~3)~~4) A ~~DGR~~ D6 LGP dozer (~~track pressure of 4.97 psi~~or equivalent equipment) will be used to grade ~~and construct~~ the 2-inches of bottom alluvium~~berms and channels~~ to minimize over-compaction.

~~4)~~5) Seed will be hand broadcast due to safety issues of using equipment on slopes~~berms~~.

~~5)~~6) Permanent ~~E~~erosion mat will be placed and stapled per manufacturer's recommendations and as shown on the DRAWINGS. NAG P550 (or equivalent) will be installed on the channel bottom and sideslopes. NAG C350 (or equivalent) will be installed on the buttress sideslope.

~~6)~~7) No vehicles or equipment will be allowed on the berms or in the channels without specific authorization from the RM.

C. ~~Temporary Erosion Control (~~Diversion Berms~~)~~

1) A D6 LGP dozer (or equivalent equipment) will be used to grade and construct the diversion berms to minimize over-compaction.

2) Seed will be hand broadcast due to safety issues of using equipment on berms.

3) Erosion mat (NAG C125 BN~~)~~ or equivalent) will be placed per manufacturer's recommendations and as shown on the DRAWINGS.

4) Temporary checkdams (Nilex Geo~~b~~ridge or equivalent) will be installed as per manufacturers recommendations and as shown on the DRAWINGS.

5) No vehicles or equipment will be allowed on the berms or in the channels without specific authorization from the RM.

D. FLEXIBLE GOWTH MEDIUM

1) Strictly comply with manufacturer's installation instructions and recommendations. Use approved hydro-spraying machines with fan-type nozzle (50-degree tip). To achieve optimum soil surface coverage apply FGM from opposing directions to soil surface.

2) Erosion Control and Revegetation:
Step One: Apply seed, fertilizer and other soil amendments with small amount of ~~Flexterra~~FGM for visual metering.
Step Two: Mix 50 lb of FGM per 125 gallons ~~(23 kg/475 liters)~~ of water; confirm loading rates with equipment manufacturer.

E. FIBER FITRATION TUBE

Fiber filtration tubes (FFTs - Terra-Tubes or equivalent) may be installed according to manufacturers instructions to supplement FGM erosion control. ~~For maximum performance Terra Tubes must be installed to maintain intimate contact with the soil surface. Terra Tubes should be installed prior to hydraulic or dryland seeding applications. They may be installed before or after the installation of rolled erosion control products. (RECPs). Smooth soil surface and remove all obstructions >1"-2" in diameter. Deploy Terra Tubes FFT where material is to be installed.~~

~~2. Anchor the upstream side of FFT using 6"- 8"u-shaped wire staples or approved devices at 1' intervals. Position anchors 1" inward from upper edge of FFT and drive flush to soil surface.~~

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~~3. Raise tube to fullest height and drive 12"-18" wooden stakes or approved metal rods through downstream side of FFT at 2' intervals. Drive stakes 1" inward from downstream edge of FFT, leaving 2"-3" of the stake protruding above the FFT. Take care not to compress the FFT structure~~

~~4. The FFT should appear more rectangular than round. Backfill and compact loose soil against upstream side of FFT.~~

1. ~~Overlap adjacent FFT roll ends by a minimum of 1'. Reduce stake interval on downslope (downstream) FFT to 1' interval making sure to place a stake at the terminus of the FFT. Continue to use wire staples on 1" centers on upslope side of FFT. Extend next FFT 1' past terminus and upslope of preceding FFT and place wire staples on 1' intervals. Then, drive stakes through outer 1" of the overlapped FFTs to complete the overlap~~

~~B. See Attachment for additional information.~~

END OF SECTION

Notes from 6/1/05 Field Visit to Old Landfill
David L. Buckner, ESCO Associates

The remediation site at the Old Landfill was visited 6/1/05 to ascertain the nature of salvaged and stored topsoil material and its potential use in the reestablishment of a plant growth medium on the Old Landfill cover. The East stockpile consisted of material removed from a strip adjacent to Woman Creek. Included were small cobbles (<10% volume) in a matrix of dark, organic enriched sandy clay loam (USDA texture). This material would be best used as a subsoil (i.e. not placed as the top layer). Because of its fine texture, the relatively high soil moisture storage capacity of this material could best be used best in a position beneath another material that itself had a higher infiltration rate and an ability to accept moisture then retain it briefly as it moved down into the sandy clay loam.

The west stockpile consisted of very dark and apparently favorable material that had a loam (USDA) texture. This soil will serve very well as a topdressing layer, functioning as the moisture-accepting layer.

Use of matting: The CA350 matting that includes the 3-dimensional plastic mesh and will be used on the lower slope edges should have a soil cover a few inches thick over it. Mat used upslope (125 BN) should be placed on the surface.

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ENGINEERING CHANGE REQUEST

PROJECT	Cover Original Landfill	ECR NO.	009
JOB NUMBER	T0113090	PAGE	1 OF 20
LOCATION	RFETS	RFI DATE	7-6-05
		REPLY DATE	7-7-05

TO	RANDY THOMPSON	COMPANY	EARTH-TECH
SUBJECT	GEOTEXTILE	LOCATION	OLF - ROCKY FLATS
DRAWING NO.	N/A	SPEC. NO.	02223

CHANGE REQUESTED

QA TEST RESULTS INDICATE SOME ROLLS ARE LESS 8OZ. GEOTEXTILE HOWEVER THE PERMIBILITY AND PUNCTURE STRENGHT ARE ACCEPTABLE

REPLY REQUIRED BY 7-7-05

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

[signature]
CONTRACTOR REP SIGNATURE

7-6-05
DATE

POTENTIAL IMPACT NOTICE
- __ SCHEDULE
- __ LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER ____________

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

The nonwoven geotextile roll weights are in the range of 7.3 to 8.5 oz. Because the functional properties (permeability and puncture strength) ~~are~~ still meet specification, the actual unit weight of the rolls is not as significant a property. This material is acceptable.

[signature] M Keating	7/7/05
RM	DATE
[signature] for RANDY THOMPSON	7/7/05
DM	DATE
[signature] for J. Rahe	7/7/05
CQAE	DATE
Carl Spreng	7/13/05
CDPHE REPRESENTATIVE	DATE

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ADVANCED TERRA TESTING, Inc.
ATT
833 Parfet Street • Lakewood, Colorado 80215 • (303) 232-8308 • Fax: (303) 232-1579

Mr. Bruce Marshall
Tetra Tech - RMC
1900 S. Sunset Street, Suite 1-F
Longmont, CO 80501

June 28, 2005

RE: RFETS-OLF Construction QA
Project #19-4886.002.00

Dear Mr. Spitzer,

Thank you for choosing Advanced Terra Testing, Inc. for your geosynthetic testing needs.

Per your request, we have completed the analyses pertinent to the recent testing campaign relative to the above referenced project. The following is a table providing a summary of the various conformance testing.

Mass/Unit Area - ASTM D 6566 & ASTM D 5261

Specimen ID	Mass/Unit Area (gms/m^2)	Mass/Unit Area (oz/yd^2)
TRM 1 (Erosion Matting)	442.4	13.1
TRM 2 (Erosion Matting)	454.4	13.4
NG0986659 (Non-Woven G.T.)	286.7	8.5
2.41487 (Non-Woven G.T.)	270.9	8.0
NG0986659 (Non-Woven G.T.) Re-Test	258.9	7.6
2.41487 (Non-Woven G.T.) Re-Test	249.2	7.3
1.76780 (Non-Woven G.T.)	277.7	8.2

Rod Puncture - ASTM D 4833

Specimen ID	Puncture (lbs)
NG0986659 (Non-Woven G.T.)	125.7
2.41487 (Non-Woven G.T.)	121.9
NG0986659 (Non-Woven G.T.) Re-Test	110.1
2.41487 (Non-Woven G.T.) Re-Test	123.9
1.76780 (Non-Woven G.T.)	124.9

Water Permeability of Geotextiles by Permittivity - ASTM D 4491

Specimen ID	Permittivity ($sec.^{-1}$)	Permeability (cm./sec.)	Flow Rate ($gpm/ft.^2$)
NG0986659 (Non-Woven G.T.)	2.13	0.38	159
2.41487 (Non-Woven G.T.)	2.01	0.39	150
NG0986659 (Non-Woven G.T.) Re-Test	2.35	0.36	175
2.41487 (Non-Woven G.T.) Re-Test	2.02	0.34	151

K:\TT2617\TTFI0605.lwp

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Apparent Opening Size - ASTM D 4751

Specimen ID	(U.S. standard sieve size)	(mm)
NG0986659 (Non-Woven G.T.)	100-140	0.150
2.41487 (Non-Woven G.T.)	100-140	0.147
NG0986659 (Non-Woven G.T.) Re-Test	70-100	0.165
2.41487 (Non-Woven G.T.) Re-Test	100-140	0.148

DHL shipping had lost original samples shipped to Precision Labs for the Permeability and Apparent Opening Size. Therfore, it was neccessary to resubmit the samples. You will not be charged for any standards that were re-tested.

Should you have any questions or require additional information please, feel free to give us call.

Sincerley,

Sharon Roberts

Sharon Roberts
Geosynthetic Division Manager

K:\TT2617\TTFI0605.twp

MASS/UNIT AREA (EROSION MATTING)
ASTM D 6566

CLIENT: Tetra Tech-RMC JOB NO.: 2617-11

ROLL NO.	TRM 1	TRM 1	TRM 1	TRM 1	TRM 1
LOT NO.					
SAMPLE NO.	1	2	3	4	5
ROLL IDENTIFICATION					
DATE TESTED	06-23-05 JTR	06-23-05 JTR	06-23-05 JTR	06-23-05 JTR	06-23-05 JTR
SAMPLE DESCRIPTION					
MASS/UNIT AREA DETERMINATIONS					
Sample Length (in)	8.050	8.000	8.100	8.050	7.970
Sample Width (in)	4.000	4.050	4.080	4.080	4.020
Sample Area (cm^2)	207.74	209.03	213.21	211.90	206.71
Mass/Unit Area (gms/m^2)	421.7	388.5	492.9	484.7	424.3
Mass of Sample (gms)	8.76	8.12	10.51	10.27	8.77

Average Mass/Unit Area (5 Samples) (gms/m^2) 442.4
Average Mass/Unit Area (5 Samples) (oz/yd^2) 13.1

ROLL NO.	TRM 2	TRM 2	TRM 2	TRM 2	TRM 2
LOT NO.					
SAMPLE NO.	1	2	3	4	5
ROLL IDENTIFICATION					
DATE TESTED	06-23-05 JTR	06-23-05 JTR	06-23-05 JTR	06-23-05 JTR	06-23-05 JTR
SAMPLE DESCRIPTION					
MASS/UNIT AREA DETERMINATIONS					
Sample Length (in)	7.930	8.050	8.100	8.000	7.980
Sample Width (in)	4.000	4.110	4.070	4.000	4.050
Sample Area (cm^2)	204.64	213.45	212.69	206.45	208.51
Mass/Unit Area (gms/m^2)	387.5	498.5	490.4	504.2	391.3
Mass of Sample (gms)	7.93	10.64	10.43	10.41	8.16

Average Mass/Unit Area (5 Samples) (gms/m^2) 454.4
Average Mass/Unit Area (5 Samples) (oz/yd^2) 13.4

Data entered by: SR Date: 06/23/2005
Data checked by: JTR Date: 6/23/05
FileName: TTMATM12

ADVANCED TERRA TESTING, INC.

342

MASS/UNIT AREA (GEOTEXTILE)
ASTM D 5261

CLIENT: Tetra Tech-RMC   **JOB NO.:** 2617-11
LOCATION: Rocky Flats ULF   **PROJECT:**

ROLL NO.	NG0986659	NG0986659	NG0986659	NG0986659	NG0986659
LOT NO.					
SAMPLE NO.	1	2	3	4	5
ROLL IDENTIFICATION					
DATE TESTED	06-09-05 SKL	06-09-05 SKL	06-09-05 SKL	06-09-05 SKL	06-09-05 SKL
SAMPLE DESCRIPTION	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.
MASS/UNIT AREA DETERMINATIONS					
Sample Length (in)	7.990	8.010	7.980	8.060	8.020
Sample Width (in)	4.030	3.990	4.020	4.060	4.040
Sample Area (cm²)	207.74	206.19	206.96	211.12	209.04
Mass/Unit Area (gms/m²)	327.8	260.4	252.7	333.5	259.3
Mass of Sample (gms)	6.81	5.37	5.23	7.04	5.42

Average Mass/Unit Area (5 Samples) (gms/m²) 286.7
Average Mass/Unit Area (5 Samples) (oz/yd²) 8.5

ROLL NO.	2.41487	2.41487	2.41487	2.41487	2.41487
LOT NO.					
SAMPLE NO.	1	2	3	4	5
ROLL IDENTIFICATION					
DATE TESTED	06-09-05 SKL	06-09-05 SKL	06-09-05 SKL	06-09-05 SKL	06-09-05 SKL
SAMPLE DESCRIPTION	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.
MASS/UNIT AREA DETERMINATIONS					
Sample Length (in)	8.010	8.010	7.990	8.010	7.980
Sample Width (in)	3.960	4.010	3.980	3.970	3.960
Sample Area (cm²)	204.64	207.23	205.16	205.16	203.88
Mass/Unit Area (gms/m²)	265.8	246.1	263.2	289.5	289.9
Mass of Sample (gms)	5.44	5.10	5.40	5.94	5.91

Average Mass/Unit Area (5 Samples) (gms/m²) 270.9
Average Mass/Unit Area (5 Samples) (oz/yd²) 8.0

Data entered by: SR   Date: 06/09/2005
Data checked by: SKL   Date: 6/9/05
FileName: TTMANG24

ADVANCED TERRA TESTING, INC.

MASS/UNIT AREA (GEOTEXTILE)
ASTM D 5261

CLIENT: Tetra Tech-RMC JOB NO.: 2617-11
LOCATION: Rocky Flats ULF PROJECT:

ROLL NO.	NG0986659	NG0986659	NG0986659	NG0986659	NG0986659
DATE SAMPLED	06-14-05 RW	06-14-05 RW	06-14-05 RW	06-14-05 RW	06-14-05 RW
SAMPLE NO.	1	2	3	4	5
ROLL IDENTIFICATION	Re-Test	Re-Test	Re-Test	Re-Test	Re-Test
DATE TESTED	06-16-05 JTR	06-16-05 JTR	06-16-05 JTR	06-16-05 JTR	06-16-05 JTR
SAMPLE DESCRIPTION	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.
MASS/UNIT AREA DETERMINATIONS					
Sample Length (in)	7.980	8.000	7.970	7.980	8.000
Sample Width (in)	4.000	3.980	4.000	3.970	4.000
Sample Area (cm^2)	205.94	205.42	205.68	204.39	206.45
Mass/Unit Area (gms/m^2)	278.2	257.5	256.7	246.6	255.3
Mass of Sample (gms)	5.73	5.29	5.28	5.04	5.27

Average Mass/Unit Area (5 Samples) (gms/m^2) 258.9
Average Mass/Unit Area (5 Samples) (oz/yd^2) 7.6

ROLL NO.	2.41487	2.41487	2.41487	2.41487	2.41487
DATE SAMPLED	06-14-05 RW	06-14-05 RW	06-14-05 RW	06-14-05 RW	06-14-05 RW
SAMPLE NO.	1	2	3	4	5
ROLL IDENTIFICATION	Re-Test	Re-Test	Re-Test	Re-Test	Re-Test
DATE TESTED	06-16-05 JTR	06-16-05 JTR	06-16-05 JTR	06-16-05 JTR	06-16-05 JTR
SAMPLE DESCRIPTION	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.	Non-Woven G.T.
MASS/UNIT AREA DETERMINATIONS					
Sample Length (in)	7.990	8.000	8.000	7.970	8.000
Sample Width (in)	3.990	3.980	3.970	4.000	4.000
Sample Area (cm^2)	205.68	205.42	204.90	205.68	206.45
Mass/Unit Area (gms/m^2)	247.0	228.3	244.0	253.3	273.2
Mass of Sample (gms)	5.08	4.69	5.00	5.21	5.64

Average Mass/Unit Area (5 Samples) (gms/m^2) 249.2
Average Mass/Unit Area (5 Samples) (oz/yd^2) 7.3

Data entered by: SR Date: 06/16/2005
Data checked by: JTR Date: 6/21/05
FileName: TTMANG2R

ADVANCED TERRA TESTING, INC.

343.

MASS/UNIT AREA (GEOTEXTILE)
ASTM D 5261

CLIENT: Tetra Tech-RMC **JOB NO.:** 2617-11

ROLL NO.	1.76780	1.76780	1.76780	1.76780	1.76780
LOT NO.					
SAMPLE NO.	1	2	3	4	5
ROLL IDENTIFICATION					
DATE TESTED	06-24-05 JTR	06-24-05 JTR	06-24-05 JTR	06-24-05 JTR	06-24-05 JTR
SAMPLE DESCRIPTION					
MASS/UNIT AREA DETERMINATIONS					
Sample Length (in)	7.990	7.990	7.960	7.950	7.960
Sample Width (in)	4.000	4.000	3.980	3.990	4.000
Sample Area (cm^2)	206.19	206.19	204.39	204.65	205.42
Mass/Unit Area (gms/m^2)	251.7	270.6	292.1	270.7	303.3
Mass of Sample (gms)	5.19	5.58	5.97	5.54	6.23

Average Mass/Unit Area (5 Samples) (gms/m^2)	277.7
Average Mass/Unit Area (5 Samples) (oz/yd^2)	8.2

Data entered by: SR Date: 06/24/2005
Data checked by: JTR Date: 6/24/05
FileName: TTMA1767

ADVANCED TERRA TESTING, INC.

344

06-09-05 SKL
Chatillon Loading System
1 Kip Capacity Load Cell
2617-11

Tetra Tech-RMC
Rocky Flats-ULF
Roll #NG0986659
Rod Puncture, Geotextile
ASTM D 4833

Data Entered By: SR
SCALES X = 1.5"/IN
Y = 75.7#/IN
DISPLACEMENT RATE = 12"/MIN

Specimen Number	Load (lbs)
1	130.2
2	123.4
3	141.6
4	121.1
5	123.4
6	131.7
7	137.8
8	120.4
9	120.4
10	106.7
Average	125.7
Std. Dev.	10.0

TETRA TECH RMC 2617-11 06-09-05 SKL/SL X=1.5"/in Y=75.7# R. PUNCTURE NG0986659

Data Checked By: SKL Date: 6/9/05
Filename: K:/TT2617/TTRPNG09.lwp

ADVANCED TERRA TESTING, inc

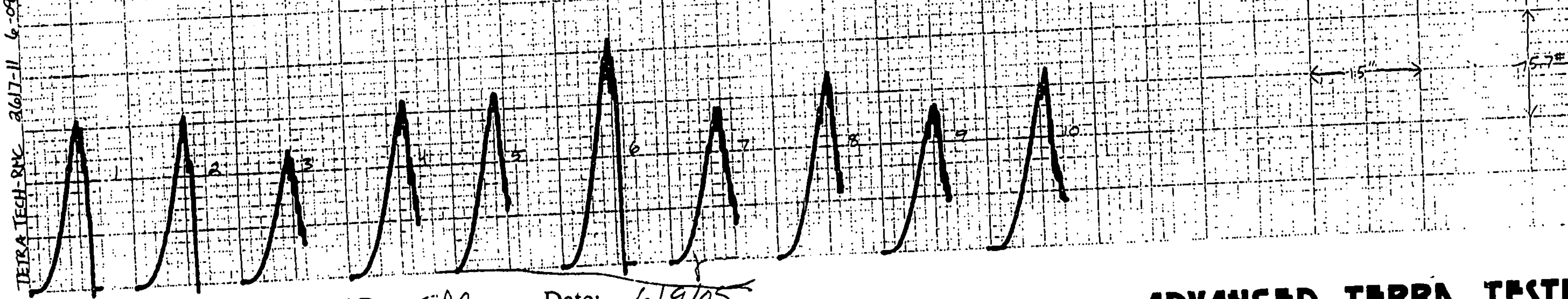
06-09-05 SKL
Chatillon Loading System
1 Kip Capacity Load Cell
2617-11

Tetra Tech-RMC
Rocky Flats-ULF
Roll #2.41487
Rod Puncture, Geotextile
ASTM D 4833

Data Entered By: SR
SCALES X = 1.5"/IN
Y = 75.7#/IN
DISPLACEMENT RATE = 12"/MIN

Specimen Number	Load (lbs)
1	120.4
2	120.4
3	92.4
4	123.4
5	126.0
6	161.2
7	108.3
8	130.2
9	103.7
10	127.2
Average	121.9
Std. Dev.	17.9

TETRA TECH-RMC 2617-11 6-09-05 SKL/SR X=1.5"/in Y=75.7# R. PUNCTURE 2.41487



Data Checked By: Skl Date: 6/9/05
Filename: K:/TT2617/TTRP2414.lwp

ADVANCED TERRA TESTING, inc

345

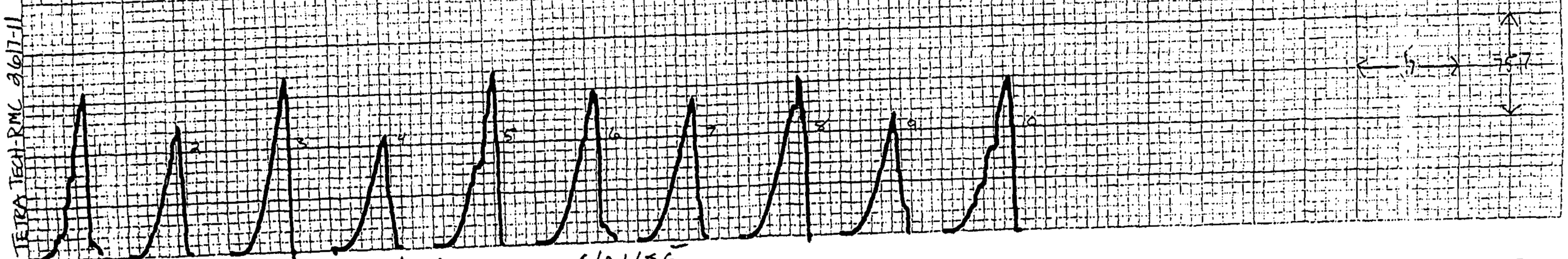
06-21-05 SKL
Chatillon Loading System
1 Kip Capacity Load Cell
2617-11

Tetra Tech-RMC
Rocky Flats-ULF
Roll #NG0986659 (RE-TEST)
Rod Puncture, Geotextile
ASTM D 4833

Data Entered By: SR
SCALES X = 1.5"/IN
Y = 5.7#/IN
DISPLACEMENT RATE = 12"/MIN

Specimen Number	Load (lbs)
1	122.6
2	95.4
3	128.7
4	84.0
5	128.7
6	113.6
7	105.6
8	118.9
9	89.3
10	114.3
Average	110.1
Std. Dev.	16.0

TETRA TECH-RMC 2617-11 6-21-05SKL NG0986659 X=1.5"/min Y=75.2# R. PUNCTURE



Data Checked By: JTR Date: 6/21/05
Filename: K:/TT2617/TTRPNG0.lwp

ADVANCED TERRA TESTING, inc

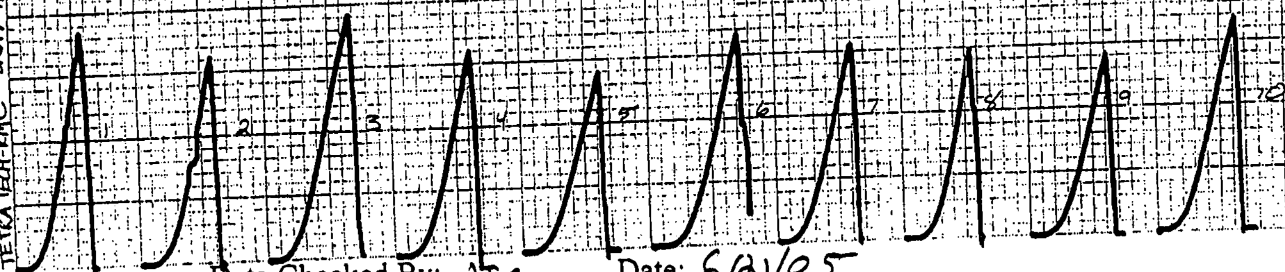
06-21-05 SKL
Chatillon Loading System
1 Kip Capacity Load Cell
2617-11

Tetra Tech-RMC
Rocky Flats-ULF
Roll #2-41487 (RE-TEST)
Rod Puncture, Geotextile
ASTM D 4833

Data Entered By: SR
SCALES X = 1.5"/IN
Y = 75.7#/IN
DISPLACEMENT RATE = 12"/MIN

Specimen Number	Load (lbs)
1	140.3
2	123.4
3	146.9
4	122.6
5	106.7
6	127.2
7	119.6
8	113.6
9	109.0
10	128.7
Average	123.9
Std. Dev.	12.9

TETRA TECH-RMC 2617-11 6-21-05 SKL 2-41487 X=1.5"/min Y=75.7# R PUNCTURE



Data Checked By: JTR Date: 6/21/05
Filename: K:/TT2617/TTRP414.lwp

ADVANCED TERRA TESTING, inc

346

06-24-05 JTR
Chatillon Loading System
1 Kip Capacity Load Cell
2617-11

Tetra Tech-RMC
Roll #1.76780
Rod Puncture, Geotextile
ASTM D 4833

Data Entered By: SR
SCALES X = 1.5"/IN
Y = 75.7#/IN
DISPLACEMENT RATE = 12"/MIN

Specimen Number	Load (lbs)
1	119.6
2	133.2
3	106.0
4	124.1
5	146.1
6	113.6
7	122.6
8	113.6
9	131.7
10	138.5
Average	124.9
Std. Dev.	12.5

X=1.5"/in Y=75.7 #/in

Tetra Tech-RMC 2617-11 Roll# 1.76780 ASTM D4833 Rod Puncture

JTR 6/24/05

Data Checked By: JTR Date: 6/24/05
Filename: K:/TT2617/TTRP1767.lwp

ADVANCED TERRA TESTING, inc

ISO 9001 - 2000

Precision Geosynthetic Laboratories

June 17, 2005

Sharon Roberts
ADVANCED TERRA TESTING INC.
833 Parfet Street
Lakewood, CO 80215

Dear Ms. Roberts: ***RE: RFETS Olf Construction QA 2617-11***

Thank you for consulting Precision Geosynthetic Laboratories for your material testing needs.

Enclosed is the ***final*** laboratory report for the testing of two (2) Nonwoven Geotextile sample(s) received June 16, 2005.

It should be noted that the test specimen and test sample used for this report was believed to be representative of the material produced under the designation herein stated. However, these results are indicative of only the specimens that were actually tested. The testing herein is based upon accepted industry practice as well as the test method listed. Precision Geosynthetic Laboratories neither accepts responsibility for nor makes claims to the final use and purpose of the material.

By accepting the data and results represented on this report, Client agrees to limit the liability of Precision Geosynthetic Laboratories from Client and all other parties for claims arising out of the use of this data to the cost for the respective test(s) represented in this report, and Client agrees to indemnify and hold harmless Precision Geosynthetic Laboratories from and against all liability in excess of the aforementioned limit.

The test data and all associated project information shall be held in confidence, not to be reproduced except in full and disclosed to other parties with the authorization of the client.

It is a company policy to keep the physical records of each job for 2 years since the receipt of the samples and keep the electronic file for 7 years. ***Failed seam samples are kept for 7 years; good seam samples are disposed after 2 weeks and conformance samples are disposed after 1 month.*** Should you need us to keep them longer, please advise us in writing.

If you have any questions or if we may be of further service, please do not hesitate to call at 800-522-4599.

Sincerely,

PRECISION GEOSYNTHETIC LABORATORIES

Maria Espitia

Maria Espitia
Quality Assurance

Cora B. Queja
Vice President

Enclosure: (Job No. G050522)

1160 North Gilbert Street, Anaheim, CA. 92801, Tel# 714-520-9631, Fax#714-520-9637

ISO 9001 - 2000

Precision Geosynthetic Laboratories

CLIENT: ADVANCED TERRA TESTING INC.
PROJECT: *RFETS Olf Construction QA 2617-11*

VERIFICATION OF MATERIAL PROPERTIES
(PGL Job No. G050522)

MATERIAL DESCRIPTION: Nonwoven Geotextile

SAMPLE(S) SENT BY: Advanced Terra Testing Inc.

DATE RECEIVED: June 16, 2005 **DATE REPORTED:** June 17, 2005

SAMPLE IDENTIFICATIONS:

SAMPLE ID	PRECISION CONTROL NUMBER
R#NG0986659	09319
R#241487	09320

TESTS REQUIRED:

TEST METHOD	DESCRIPTION
ASTM D4491	Permeability/Permittivity
ASTM D4751	Apparent Opening Size

TEST CONDITIONS: The samples were conditioned for a minimum one hour in the laboratory at 22 ± 2°C (71.6 ± 3.6°F) and at 60 ± 10% relative humidity prior to test.

TEST RESULTS:

The test results are summarized in Table(s) 1 & 2. The units in which the data are reported are included on these tables.

PRECISION GEOSYNTHETIC LABORATORIES

GAI-LAP
Initials: MC #013
Date:

Maria Espitia
Quality Assurance

Cora B. Queja
Vice President

1160 North Gilbert Street, Anaheim, CA. 92801, Tel# 714-520-9631, Fax#714-520-9637

348

TABLE 1.

MATERIAL PROPERTIES

CLIENT: ADVANCED TERRA TESTING

PROJECT: RFETS Oif Construction QA 2617-11

Date Received: 6/16/2005
Date Reported: 6/17/2005
Client Sample ID: R#NG0986659
Material Description: Non-woven Geotextile

QC'd By: ME
PGL Job No.: G050522
PGL Control No.: 9319

METHOD	DESCRIPTION	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D4491 Constant Head	Permittivity (sec.$^{-1}$) *Specimens were tested as directed in Test Method D4491 using the Constant Head method.*	2.32	2.51	2.32	2.23							2.35	0.12	2.23	2.51	
	Permeability (cm./ sec.)	0.37	0.35	0.36	0.37							0.36	0.01	0.35	0.37	
	Flow Rate (gpm/ ft.^{2})	174	188	173	166							175	9	166	188	
ASTM D4751	Apparent Opening Size (U.S. standard sieve size) *Specimens were tested as directed in Test Method D4751. Type of sieve shaker used is W.S. Tyler Rotap.*	70-100	70-100	70-100	70-100	70-100						70-100	N/A	N/A	N/A	
ASTM D4751	Apparent Opening Size (mm) *Specimens were tested as directed in Test Method D4751. Type of sieve shaker used is W.S. Tyler Rotap.*	0.161	0.170	0.159	0.152	0.183						0.165	0.012	0.152	0.183	

MD - MACHINE DIRECTION

TABLE 2.
MATERIAL PROPERTIES
CLIENT: Advanced Terra Testing
PROJECT: RFETS Olf Construction QA 2617-11

Date Received: 6/16/2005
Date Reported: 6/17/2005
Client Sample ID: R#241487
Material Description: Non-woven Geotextile

QC'd By: MC
PGL Job No.: G050622
PGL Control No.: 9320

METHOD	DESCRIPTION	1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
		SPECIMENS														
ASTM D4491	Permittivity (sec.$^{-1}$)															
Constant Head	*Specimens were tested as directed in Test Method D4491 using the Constant Head method.*															
		2.06	1.98	1.91	2.14							2.02	0.10	1.91	2.14	
	Permeability (cm./ sec.)															
		0.34	0.34	0.34	0.33							0.34	0.01	0.33	0.34	
	Flow Rate (gpm/ ft.^{2})															
		154	148	143	160							151	8	143	160	
ASTM D4751	Apparent Opening Size (U.S. standard sieve size)															
	Specimens were tested as directed in Test Method D4751. Type of sieve shaker used is W.S. Tyler Rotap.															
		100-140	100-140	100-140	100-140	100-140						100-140	N/A	N/A	N/A	
ASTM D4751	Apparent Opening Size (mm)															
	Specimens were tested as directed in Test Method D4751. Type of sieve shaker used is W.S. Tyler Rotap.															
		0.144	0.147	0.149	0.149	0.149						0.148	0.002	0.144	0.149	

MD - MACHINE DIRECTION

ISO 9001 - 2000

CAL-LAP

UKAS

Precision Geosynthetic Laboratories

June 23, 2005

Sharon Roberts
ADVANCED TERRA TESTING INC.
833 Parfet Street
Lakewood, CO 80215

Dear Ms. Roberts: ***RE: Rocky Flats ULF – Proj #2617-11***

Thank you for consulting Precision Geosynthetic Laboratories for your material testing needs.

Enclosed is the ***final*** laboratory report for the testing of two (2) Nonwoven Geotextile sample(s) received June 21, 2005.

It should be noted that the test specimen and test sample used for this report was believed to be representative of the material produced under the designation herein stated. However, these results are indicative of only the specimens that were actually tested. The testing herein is based upon accepted industry practice as well as the test method listed. Precision Geosynthetic Laboratories neither accepts responsibility for nor makes claims to the final use and purpose of the material.

By accepting the data and results represented on this report, Client agrees to limit the liability of Precision Geosynthetic Laboratories from Client and all other parties for claims arising out of the use of this data to the cost for the respective test(s) represented in this report, and Client agrees to indemnify and hold harmless Precision Geosynthetic Laboratories from and against all liability in excess of the aforementioned limit.

The test data and all associated project information shall be held in confidence, not to be reproduced except in full and disclosed to other parties with the authorization of the client.

It is a company policy to keep the physical records of each job for 2 years since the receipt of the samples and keep the electronic file for 7 years. ***Failed seam samples are kept for 7 years; good seam samples are disposed after 2 weeks and conformance samples are disposed after 1 month.*** Should you need us to keep them longer, please advise us in writing.

If you have any questions or if we may be of further service, please do not hesitate to call at 800-522-4599.

Sincerely,

PRECISION GEOSYNTHETIC LABORATORIES

Maria Espitia

Maria Espitia
Quality Assurance

Cora B. Queja
Vice President

Enclosure: (Job No. G050544)

1160 North Gilbert Street, Anaheim, CA. 92801, Tel# 714-520-9631, Fax#714-520-9637

ISO 9001 - 2000

GAI-LAP

UKAS

Precision Geosynthetic Laboratories

CLIENT: ADVANCED TERRA TESTING INC.
PROJECT: ***Rocky Flats ULF – Proj # 2617-11***

VERIFICATION OF MATERIAL PROPERTIES
(PGL Job No. G050544)

MATERIAL DESCRIPTION: Nonwoven Geotextile

SAMPLE(S) SENT BY: Advanced Terra Testing Inc.

DATE RECEIVED: June 21, 2005 **DATE REPORTED:** June 23, 2005

SAMPLE IDENTIFICATIONS:

SAMPLE ID	PRECISION CONTROL NUMBER
R#241487	09394
R#NG0986659	09395

TESTS REQUIRED:

TEST METHOD	DESCRIPTION
ASTM D4491	Permeability/Permittivity
ASTM D4751	Apparent Opening Size

TEST CONDITIONS: The samples were conditioned for a minimum one hour in the laboratory at 22 $\pm$ 2°C (71.6 $\pm$ 3.6°F) and at 60 $\pm$ 10% relative humidity prior to test.

TEST RESULTS:

The test results are summarized in Table(s) 1 & 2. The units in which the data are reported are included on these tables.

PRECISION GEOSYNTHETIC LABORATORIES

Maria Espitia
Quality Assurance

Cora B. Queja
Vice President

350

TABLE 1.

MATERIAL PROPERTIES

CLIENT: ADVANCED TERRA TESTING

PROJECT: ROCKY FLATS ULF Proj #2617-11

Date Received: 6/21/05
Date Reported: 6/23/05
Client Sample ID: R#241487
Material Description: Non-woven Geotextile

QC'd By: ME
PGL Job No.: G050544
PGL Control No.: 9394

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D4491	Permittivity (sec.$^{-1}$)															
Constant Head	*Specimens were tested as directed in Test Method D4491 using the Constant Head method.*															
		2.01	1.93	2.03	2.05							2.01	0.05	1.93	2.05	
	Permeability (cm./ sec.)															
		0.39	0.38	0.39	0.39							0.39	0.00	0.38	0.39	
	Flow Rate (gpm/ ft.^{2})															
		151	145	151	153							150	4	145	153	
ASTM D4751	Apparent Opening Size (U.S. standard sieve size)															
	Specimens were tested as directed in Test Method D4751. Type of sieve shaker used is W.S. Tyler Rotap.															
		100-140	100-140	100-140	100-140	100-140						100-140	N/A	N/A	N/A	
ASTM D4751	Apparent Opening Size (mm)															
	Specimens were tested as directed in Test Method D4751. Type of sieve shaker used is W.S. Tyler Rotap.															
		0.147	0.147	0.146	0.147	0.149						0.147	0.001	0.146	0.149	

MD - MACHINE DIRECTION

TABLE 2.

MATERIAL PROPERTIES

CLIENT: ADVANCED TERRA TESTING

PROJECT: ROCKY FLATS ULF Proj #2617-11

Date Received: 6/21/05
Date Reported: 6/23/05
Client Sample ID: R#NG0986659
Material Description: Non-woven Geotextile

QC'd By: ME
PGL Job No.: G050544
PGL Control No.: 9395

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D4491	Permittivity (sec.$^{-1}$)															
Constant Head	*Specimens were tested as directed in Test Method D4491 using the Constant Head method.*															
		2.16	2.22	2.04	2.08							2.13	0.08	2.04	2.22	
	Permeability (cm./ sec.)															
		0.37	0.37	0.39	0.40							0.38	0.01	0.37	0.40	
	Flow Rate (gpm/ ft.^{2})															
		162	166	153	155							159	6	153	166	
ASTM D4751	Apparent Opening Size (U.S. standard sieve size)															
	Specimens were tested as directed in Test Method D4751. Type of sieve shaker used is W.S. Tyler Rotap.															
		100-140	100-140	100-140	100-140	100-140						100-140	N/A	N/A	N/A	
ASTM D4751	Apparent Opening Size (mm)															
	Specimens were tested as directed in Test Method D4751. Type of sieve shaker used is W.S. Tyler Rotap.															
		0.150	0.149	0.150	0.150	0.150						0.150	0.000	0.149	0.150	

MD - M E DIRECTION
TD - T VERSE DIRECTION

ENGINEERING CHANGE REQUEST

PROJECT	**Cover Original Landfill**	ECR NO.	10
JOB NUMBER	**T0113090**	PAGE	1 OF 1
LOCATION	**RFETS**	ECR DATE	7/7/2005
		REPLY DATE	7/8/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	East Drainage ChannelAccess Rd.	LOCATION	Rocky Flats OLF
DRAWING NO.	51788-008	SPEC. NO.	

CHANGE REQUESTED

To install the east drainage channel at the OLF, a portion of the existing Buffer Zone access road will be relocated around the channel to the east. This relocation will require filling approximately 50-feet of the SID. The PBA project boundary extends approximately 100-feet to the east. KH Ecology has approved the road relocation.

REPLY REQUIRED BY 7/8/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE DATE

POTENTIAL IMPACT NOTICE
__ SCHEDULE
X LABOR
X MATERIAL
__ NO IMPACT
X OTHER **wetlands**

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

Because this road relocation is outside the scope of work of the Original Landfill Accelerated Action Design, and there is no change to said design, a DM signature is not applicable.

Acceptable with diversion of seep under area of east road into SID

J M Keating
RM DATE

N/A
DM DATE

J.H. Eale 7/20/05
CQAE DATE

Raymond B 7-20-05
CDPHE REPRESENTATIVE DATE

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Keating, Michael

From: Carl Spreng [cspreng@smtpgate.dphe.state.co.us]
Sent: Monday, July 11, 2005 12:02 PM
To: Randy.Thompson@earthtech.com; Scott.Powell@earthtech.com; Moritz.Vera@epamail.epa.gov; John.Rahe@mfgenv.com; Birk, Bob; Keating, Michael; Spreng, Carl
Cc: nng-a-qui@burnsmcd.com; Ward, David; McQueary, Steven; Larry.bruskin@state.co.us
Subject: Re: ECR-010.xls

Mike:

This change request does not seem to affect the design of the landfill itself. We "verbally" approved the request with this email and will sign off at this week's OLF Progress Meeting.

Carl

>>> "Keating, Michael" <Michael.Keating@rfets.gov> 07/07/05 04:13PM
>>>
Please review. We need to relocate this access road prior to constructing the east channel at the OLF to allow access into the South Buffer Zone. We want to start this work on Monday. NOTE: The access road is not part of the design.

<<ECR-010.xls>>

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ENGINEERING CHANGE REQUEST

PROJECT	Cover Original Landfill	ECR NO.	011
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	ECR DATE	7/26/2005
		REPLY DATE	7/27/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Diversion berm height	LOCATION	Rocky Flats OLF
DRAWING NO.	51788-012A, Detail 1	SPEC. NO.	N/A

CHANGE REQUESTED

The height of each diversion berm has been specified in the drawings to be 3 feet as measured from the top-of-cover to the top-of-berm. Because of the 18% grade on the cover, this results in a 2-foot V-ditch depth on the uphill side of the berm. However, the required V-ditch depth was determined in the Design Analysis to be a minimum of 3 feet deep. Constructing a berm large enough to hold 3 feet of depth on the uphill side of an 18% grade would require it to be 4.5 feet high and would more than double the volume of material required. In addition, there are areas where the diversion berms must be "field fit". Please clarify acceptable slopes in these areas.

REPLY REQUIRED BY **7/29/2005**

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE
- X SCHEDULE
- X LABOR
- X MATERIAL
- __ NO IMPACT
- __ OTHER

CONTRACTOR REP SIGNATURE   DATE 8/22/05

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

As discussed in the attached analysis, it is acceptable to construct the diversion berms in accordance with Drawing 12A so long as the slope is between 2-5%. Constructing the diversion berms with a slope of 2% allows for 4 inches (0.33 feet) of freeboard. If future settling occurs and the slopes are decreased, the diversion berms still have the capacity to handle the 1000-year 24-hour storm event. Beyond a 5% slope, the freeboard capacity increases but the proposed temporary erosion control (NAG C125) is not sufficient.

The Design Team recommends that during the monitoring and maintenance period at the Orignal Landfill, all diversion berms be inspected for evidence settlement or sloughing which would affect the freeboard capacity.

RM   DATE 8/24/05

DM   DATE 8/11/05

CQAE   DATE 8/25/05

Carl Spreng
CDPHE REPRESENTATIVE   DATE 9/6/05

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ENGINEERING CHANGE REQUEST 011
(REVISION 1)

DIVERSION BERM CONSTRUCTION

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
ACCELERATED ACTION DESIGN FOR THE ORIGINAL LANDFILL

AUGUST 11, 2005

Prepared by:

Earth Tech, Inc.
5575 DTC Parkway, Suite 200
Englewood, Colorado 80111
(303) 694-6660

This calculation was performed by Earth Tech, Inc. Although each sheet composing this calculation may or may not be initialed, it has nonetheless been reviewed and checked.

Prepared By:	RA	Date: 8/11/05
Checked By:	SP	Date: 8/11/05
Approved By:	RT	Date: 8/11/05

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
5575 DTC Parkway, Suite 200
Englewood, Colorado 80111

Project: RFETS - Original Landfill Accelerated Action   Project No. 57378.6040   Date: 8/11/05

Subject: Landfill Engineering - ECR-011

By: RA   Date: 8/11/05   Chk By: SP   Date: 8/11/05   App By: RT   Date: 8/11/05

1.0 INTRODUCTION

Engineering change request (ECR) 011 discusses the height of the Original Landfill diversion berms. Surface water calculations in Appendix D of the Final Design specify a diversion berm flow depth of 3 feet based on a peak flow-depth of 1.67 feet and one foot of freeboard. Design drawing 12A shows the berm height at 3 feet which, due to the 18% grade of the cover, results in a channel depth of 2 feet. A 2-foot channel depth will therefore have 0.33 feet or 4 inches of freeboard. ECR-011 requests clarification as to whether the berms should be built in accordance with Design Drawing 12A or heightened.

In ideal conditions, 4 inches of freeboard is acceptable assuming the diversion berms are placed at 2%. Due to potential settlement and "field fitting" of the diversion berms, the slopes will vary. To determine if 4 inches of freeboard is acceptable assuming varying slopes, a sensitivity analysis was conducted using varying diversion berm flow line slopes.

2.0 DIVERSION BERM FREEBOARD SENSITIVITY ANALYSIS

To conduct the sensitivity analysis, the SEDCAD models from Appendix D of the Final Design were modified by adjusting the slope input. Flatter slopes will slow down the flow and result in a greater flow depth. Steeper slopes will result in lesser flow depths but greater erosion. Therefore, the maximum flow depth was determined with the use of NAG software similar to Appendix D. For conservative purposes, the model from the diversion berm with the greatest peak flow (the east diversion berms) was used. The SEDCAD and NAG results are attached and summarized in the table below:

Diversion Berm Slope	Flow Depth (1000 Year)	Erosion
1.3%	1.98 feet	Stable-Assumed since slope is less than 2%
2.0%	1.79 feet	Stable-See Appendix D
5.0%	1.44 feet	Stable

The results show that the freeboard and erosion control is sufficient as shown in Drawing 12A so long as the slopes of the diversion berms are between 1.3% and 5.0%. Any areas where the berms need to be "field fit" shall not be greater than 5.0% or less than 2.0% to allow for freeboard.

3.0 SETTLING

The sensitivity analysis shows that a freeboard based on the 1,000 year event of 4 inches is sufficient so long as the diversion berms are placed at 1.3-5%. To further evaluate the freeboard capacity, potential settling of the cover system was analyzed which may modify the diversion berm slopes. Settlement rates from Appendix B of the Final Design were used and for purposes of this analysis, points B and E from appendix B were used since they are closest to following the line of a diversion berm (see attached figure). The distance between these points is assumed to be 200 feet and for purposes of this calculation, the slope is assumed to be 2% (slope of a diversion berm). Total settlement for points B and E was calculated in Appendix C (Table B-5) at 2.54 and 1.34 feet respectively. The following revised slopes were calculated based on total and differential settlement.

Settlement	Revised Slope
Total (both B and E settling)	1.4%
Differential (B only settling)	0.73%
Differential (E only settling)	2.7%

These revised slopes are acceptable for the following reason:

The diversion berms were sized based on the flow depth that will occur towards the end of the diversion berm flow length or when the entire watershed is contributing. This means that the flow depth upstream would be less since less of the watershed is contributing (see attached figure). The critical revised slope calculated is 0.73% since it is outside the 1.3-5% range determined above. This slope was calculated based on settlement between points B and E which are within the limit of waste and are located in the upstream portion of the diversion berm where the flow depth requirement is less. Points B and E were used because there is borehole data available to support a more detailed differential settlement evaluation. Assuming this differential settlement occurs and the slope changes to 0.73% between points B and E (this represent maximum settlement at point B and ZERO settlement at point E), the watershed that feeds the diversion berm is 1.0 acres. As shown in the attached SEDCAD reports, the resultant flow depth for a 1-acre watershed from the 1,000-year 24-hour event is 1.85 feet and therefore the design flow depth is sufficient.

All diversion berms terminate outside the limit of waste where the differential settlement will not be as extreme as areas within the limit of waste. To evaluate this, use the settlement at point E which is a typical point near the edge of the waste and a diversion berm termination point (see attached figure). The distance between these points is 320 feet but assume 200 feet for conservative purposes. If point E settles 1.34 feet, and the termination point of the diversion berm does not, the resulting slope is 1.33% or within the acceptable range.

3.1 CONCLUSIONS

The diversion berm flow depth shown on Drawing 12A is acceptable for installation so long as the diversion berms are placed between 2% and 5%. In the long term, slopes can be reduced due to differential settling and still have sufficient freeboard to handle the 1,000-year storm event. However, monitoring for differential settlement resulting in unacceptable diversion berm slopes must be included in the monitoring and maintenance plan.

ATTACHMENTS

1.3% SLOPE
1000-YEAR 24-HOUR STORM EVENT
2.5 ACRE WATERSHED

Structure Detail:

Structure #1 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	1.3	D, B	0.02			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.46 cfs		19.46 cfs	
Depth:	1.33 ft	1.35 ft	$\boxed{1.98 \text{ ft}}$	2.00 ft
Top Width:	11.46 ft	11.64 ft	16.99 ft	17.17 ft
Velocity:	2.55 fps		1.16 fps	
X-Section Area:	7.64 sq ft		16.79 sq ft	
Hydraulic Radius:	0.649		0.962	
Froude Number:	0.55		0.21	
Roughness Coefficient:	0.0500		0.1427	

2% SLOPE
1000-YEAR 24-HOUR STORM EVENT
2.5 ACRE WATERSHED

Structure Detail:

Structure #1 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	2.0	D, B	0.21			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.46 cfs		19.46 cfs	
Depth:	1.22 ft	1.43 ft	$\boxed{1.79 \text{ ft}}$	2.00 ft
Top Width:	10.47 ft	12.27 ft	15.37 ft	17.17 ft
Velocity:	3.06 fps		1.42 fps	
X-Section Area:	6.37 sq ft		13.73 sq ft	
Hydraulic Radius:	0.593		0.870	
Froude Number:	0.69		0.26	
Roughness Coefficient:	0.0486		0.1354	

5% SLOPE
1000-YEAR 24-HOUR
STORM EVENT
2.5 ACRE WATERSHED

Structure Detail:

Structure #1 (Vegetated Channel)

Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	5.0	D, B	0.56			5.0

Vegetated Channel Results:

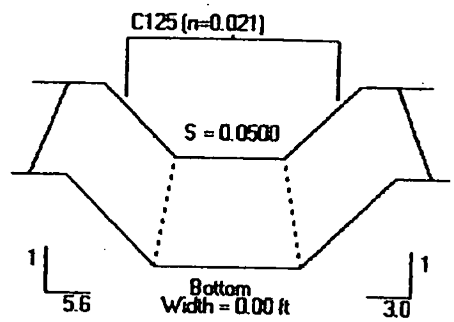
	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	19.46 cfs		19.46 cfs	
Depth:	1.00 ft	1.56 ft	$\boxed{1.44 \text{ ft}}$	2.00 ft
Top Width:	8.63 ft	13.44 ft	12.40 ft	17.22 ft
Velocity:	4.50 fps		2.18 fps	
X-Section Area:	4.33 sq ft		8.94 sq ft	
Hydraulic Radius:	0.488		0.702	
Froude Number:	1.12		0.45	
Roughness Coefficient:	0.0458		0.1209	

DIVERSION BERM
5% SLOPE
EROSION PROTECTION

North American Green - ECMDS Version 4.2	7/27/200 04:11 PM COMPUTED BY: R. Archibald
PROJECT NAME: Rocky Flats - OLF	PROJECT NO.:
FROM STATION/REACH: Diversion TO STATION/REACH:	DRAINAGE AREA: DESIGN FREQUENCY:

HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
14.4	2.0	7.46	1.93	0.33	0.67



BEND RESULTS

Bend Radius (ft)	Length Protection (ft)	Super Elevation Depth (ft)
5.0	7.7	2.7

Not to Scale

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	C125	Unvegetated					2.25	2.09	1.08	STABLE
	Staple D									
Bend	C125	Unvegetated					2.25	2.09	1.08	STABLE
	Staple D									

0.73% SLOPE
1000-YEAR 24-HOUR
STORM
EVENT
1.0 ACRE WATERSHED

Structure Detail:

Structure #1 (Vegetated Channel)

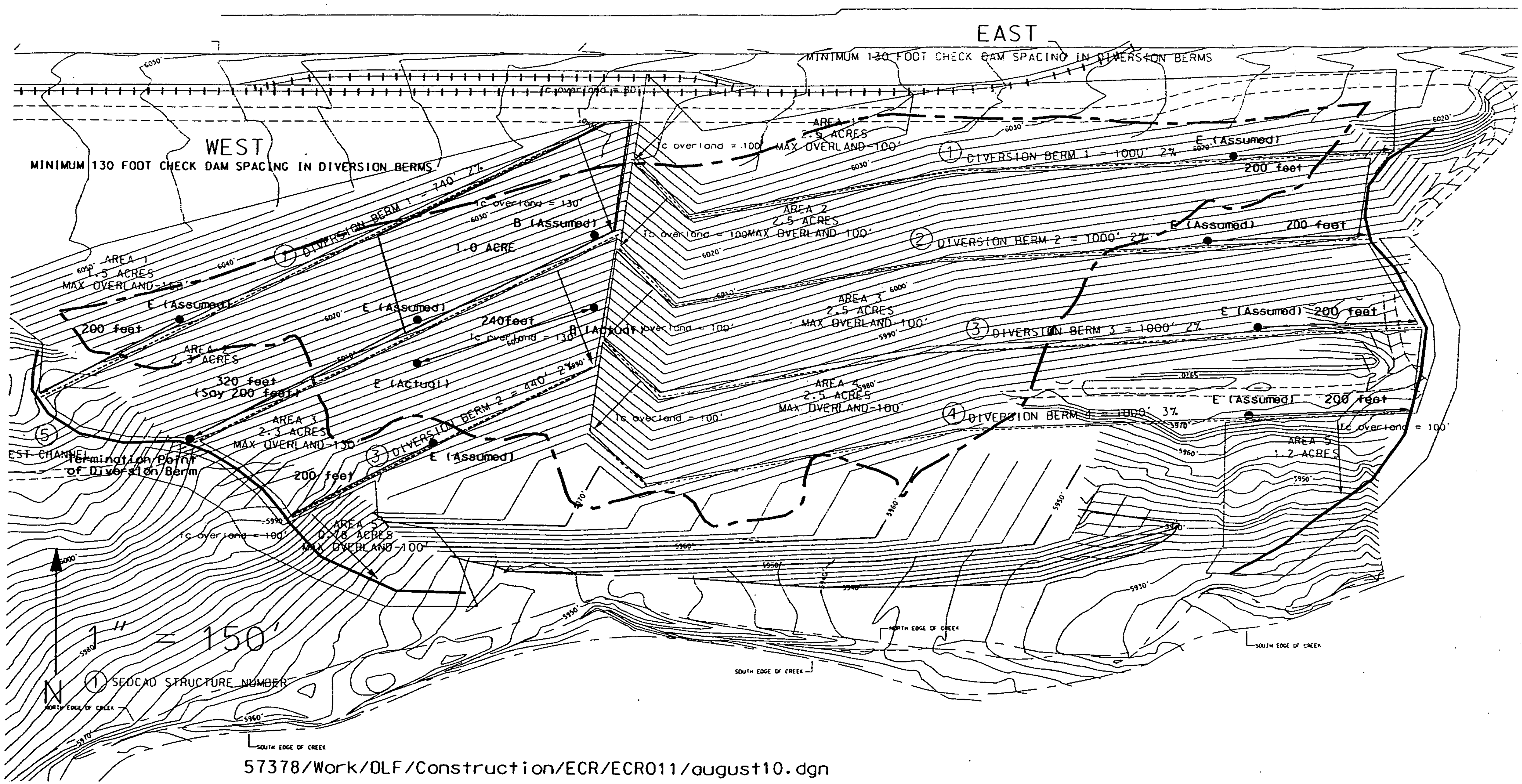
Triangular Vegetated Channel Inputs:

Material: Grass mixture

Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.0:1	5.6:1	0.7	D, B	0.15			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	7.79 cfs		7.79 cfs	
Depth:	1.15 ft	1.30 ft	$\boxed{1.85 \text{ ft}}$	2.00 ft
Top Width:	9.90 ft	11.19 ft	15.88 ft	17.17 ft
Velocity:	1.37 fps		0.53 fps	
X-Section Area:	5.70 sq ft		14.65 sq ft	
Hydraulic Radius:	0.561		0.899	
Froude Number:	0.32		0.10	
Roughness Coefficient:	0.0632		0.2230	



57378/Work/OLF/Construction/ECR/ECR011/august10.dgn

358

ENGINEERING CHANGE REQUEST

PROJECT	**Cover Original Landfill**	ECR NO.	012
JOB NUMBER	**T0113090**	PAGE	1 OF 1
LOCATION	**RFETS**	ECR DATE	8/11/2005
		REPLY DATE	8/19/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Seep under diversion berm 3	LOCATION	Rocky Flats OLF
DRAWING NO.	51788-011	SPEC. NO.	

CHANGE REQUESTED

A seep has developed in the footprint of diversion berm 3. Please advise a drain design.

REPLY REQUIRED BY 8/12/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

POTENTIAL IMPACT NOTICE

__ SCHEDULE
X LABOR
X MATERIAL
__ NO IMPACT
__ OTHER ______

[signature]
CONTRACTOR REP SIGNATURE

8/22/05
DATE

INFORMATION TO CONTRACTOR

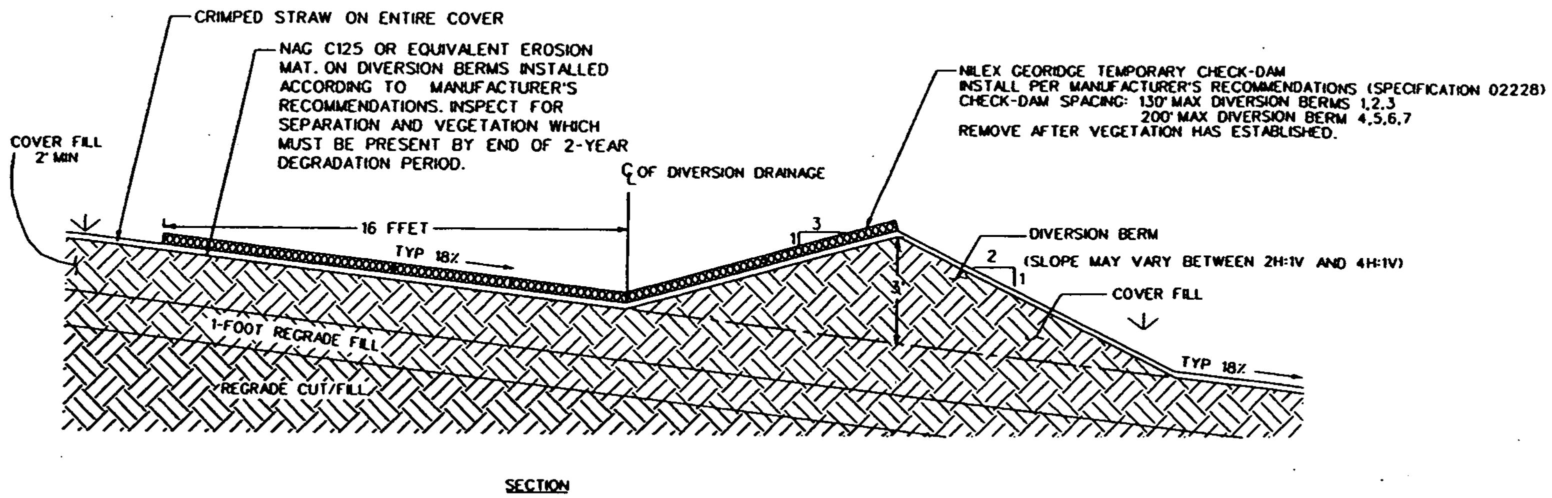
RESPONSE TO CHANGE REQUEST

The seep underneath diversion berm 3 may undermine the integrity of the berm, so the water must be drained away from the berm. Because of the seep's proximity to the buttress, the design team recommends draining the water into the buttress drain rock layer, which is designed to handle subsurface flows. Please see the attached design for a T-shaped trench partially filled with 6" riprap wrapped in geotextile to capture the water from the seep and drain it into the buttress drain rock. A plan view of the T-trench drain is presented in Drawing 9 (Issue 2). A cross-section detail of the trench is presented in Detail 5 on Drawing 12A (Issue

During construction, conduct an as-built survey of A) the extent of the wet spot prior to trench excavation, B) the trench end points and intersections, C) the bottom-of-trench elevations every 10', and D) the top-of-riprap elevations every 10'.

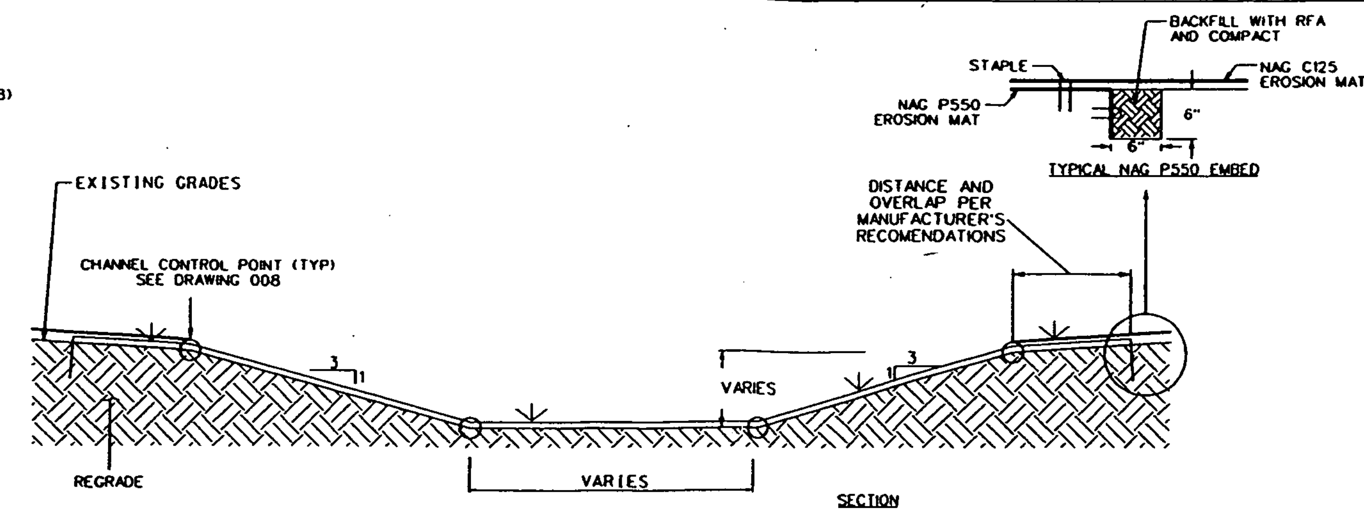
J M Keating RM	8/24/05 DATE
[signature] FOR RANDY THOMPSON DM	8/19/05 DATE
J. H. [signature] QAE	8/25/05 DATE
Carl Spreng CDPHE REPRESENTATIVE	9/16/05 DATE

359



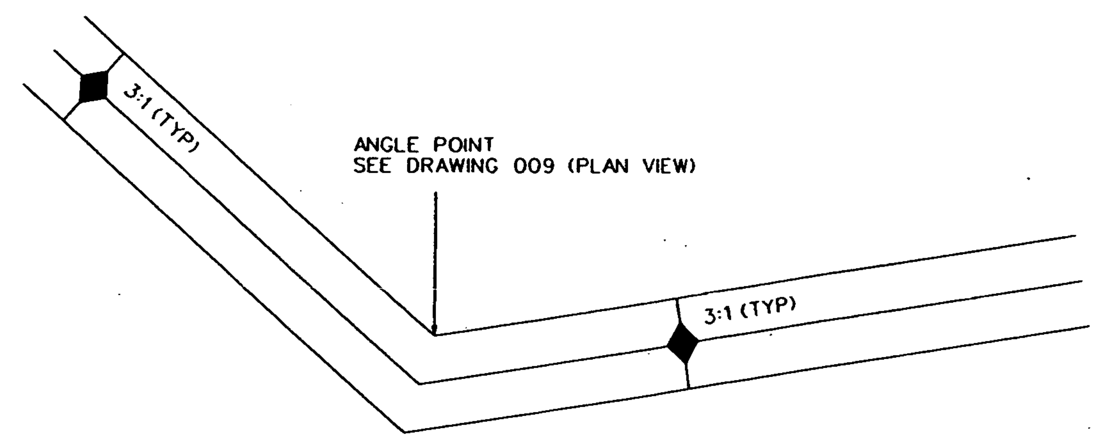
NOTE: IN AREAS OUTSIDE OF THE WASTE "FOOTPRINT" COVER SOIL MAY BE LESS THAN 2' (IN TRANSITION AREAS) OR NO COVER SOIL

DIVERSION BERM (SECTION)
NTS
1 — 9 | 12A

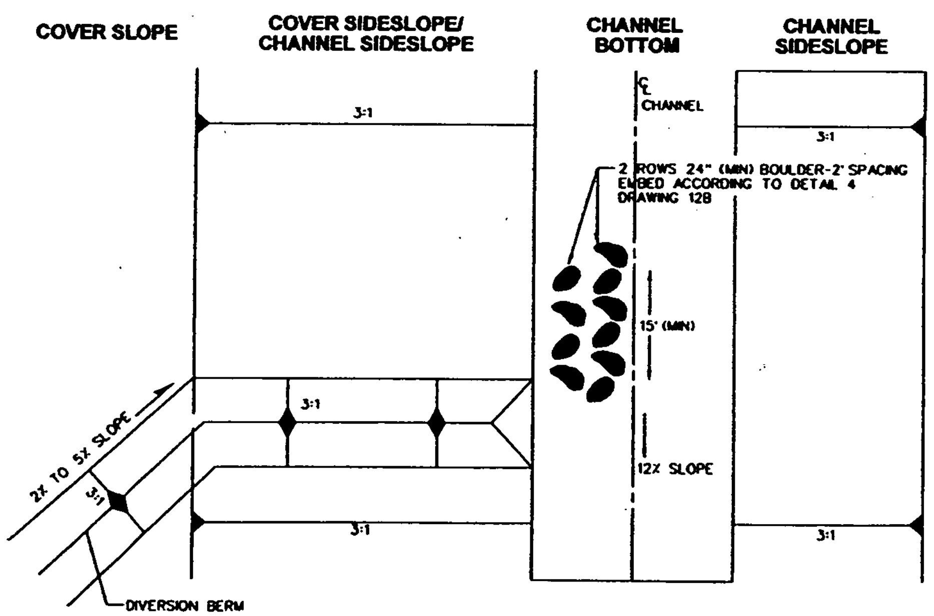


NOTE: NAG P550 OR EQUIVALENT EROSION MAT ON CHANNEL BOTTOM AND ALL SIDESLOPES. INSTALL ACCORDING TO MANUFACTURER'S RECCOMENDATIONS.

PERMANENT/GRASS LINED CHANNEL DETAIL (SECTION)
NTS
2 — 9 | 12A

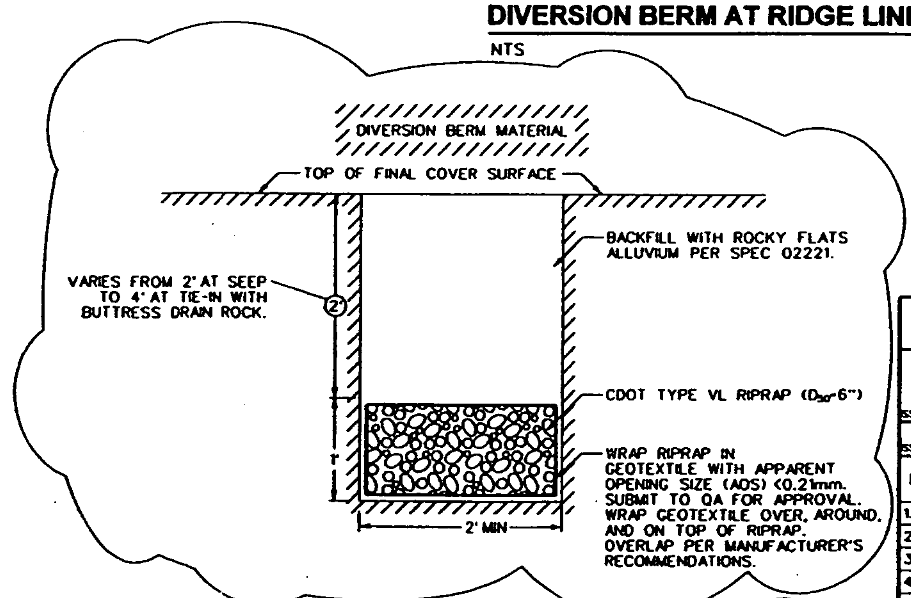


DIVERSION BERM AT RIDGE LINE (PLAN VIEW)
NTS
4 — 9 | 12A



NOTE: NAG P550 OR EQUIVALENT EROSION MAT ON CHANNEL BOTTOM, CHANNEL SIDESLOPES, DOWNSLOPE CHANNEL BOTTOM, AND DOWNSLOPE CHANNEL SIDESLOPES. NAG C125 OR EQUIVALENT ON COVER SLOPE.

DOWNSLOPE CHANNEL TRANSITION FROM DIVERSION BERM TO CHANNEL (PLAN VIEW)
NTS
3 — 9 | 12A



SEEP DRAIN CROSS-SECTION
NTS
5 — 9 | 12A

DRAFT COPY

2 ISSUE	SEEP DRAIN DESIGN ADDED — EARTH TECH DESIGN COMPANY	REVISION DESCRIPTION — DATE / DSGN / DWN / CHKD / IV / APVD / CLASS / ST3T0 PROJECT/CHARGE NO.
0 ISSUE	ORIGINAL ISSUE	DESCRIPTION

KEYWORDS	TOLERANCES FRACT. ANGLE DEC. UNLESS NOTED OTHERWISE	DESIGN COMPANY		
1.		DESIGNED BY R. ARCHIBALD	RA	5/12/05
2.		DRAWN BY A. SHOTNIK	AS	5/12/05
3.		CHECKED BY R. THOMPSON	RT	5/12/05
4.		INDEPENDENT VERIFIER S. LAWRENCE	SL	5/12/05
5.	REMOVE BURRS AND SHARP EDGES	APPROVED BY R. THOMPSON	RT	5/12/05
BLDG/FACILITY SITE	NEXT ASSEMBLY NA	CLASSIFIER		
ROOM/AREA NA	SCALE: AS SHOWN			
GRID COORD./COL NO. NA				

PROJECT/WCF NO. 020525

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS OFFICE GOLDEN, COLORADO

Rocky Flats Environmental Technology Site
GOLDEN, COLORADO

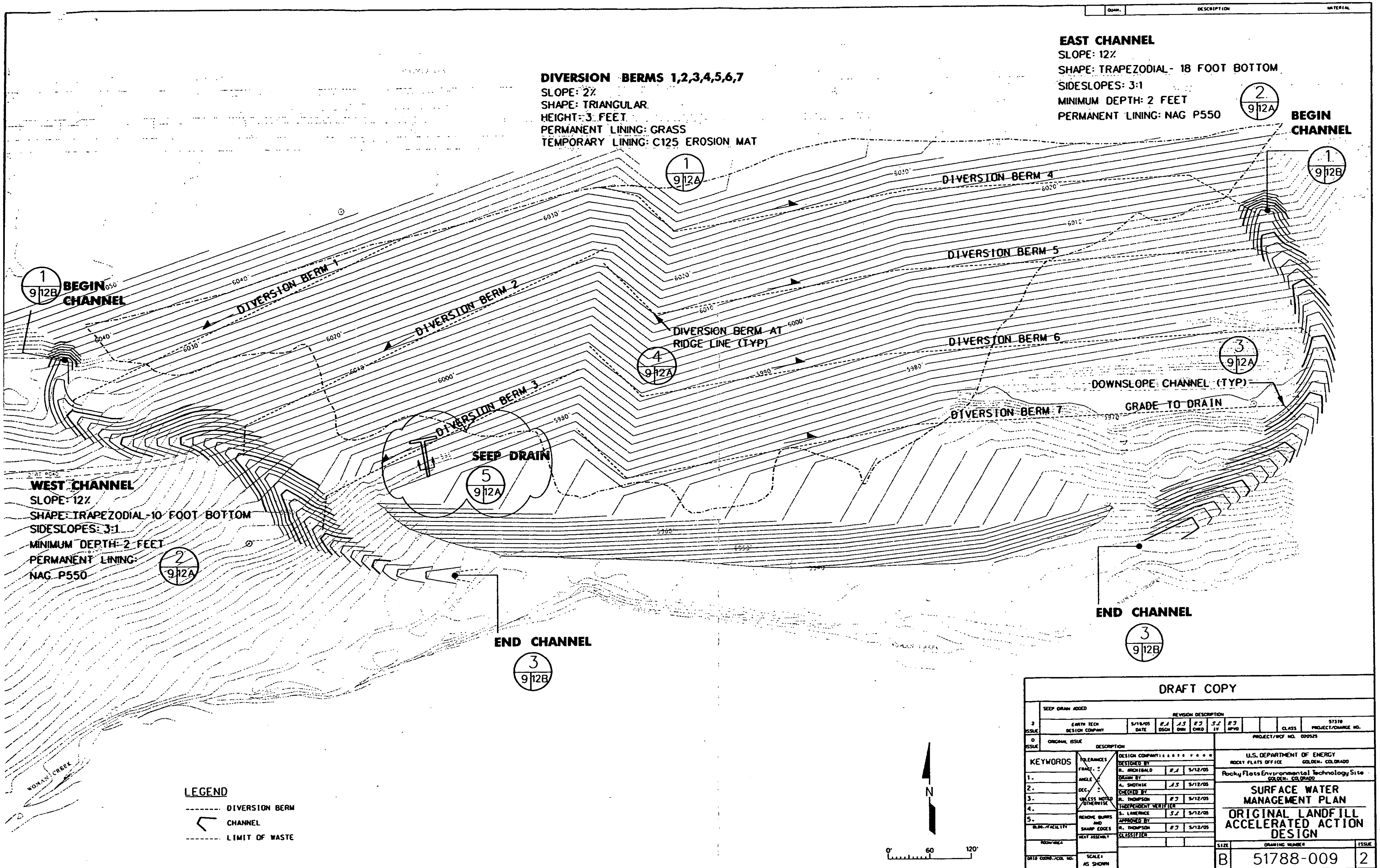
LANDFILL COVER DETAILS SURFACE WATER CONTROLS

ORIGINAL LANDFILL ACCELERATED ACTION DESIGN

SIZE	DRAWING NUMBER	ISSUE
B	51788-012A	2

..\group\cad\rocky_flats\olf_2005\details\detailrev2.dgn 8/17/05

360



:\GROUP\CAD\ROCKY_FLATS\Olf_2005\SurfWater\SurfREV1.dgn Date: 8-16-2005

ENGINEERING CHANGE REQUEST

PROJECT	Cover Original Landfill	ECR NO.	13
JOB NUMBER	T0113090	PAGE	1 OF 1
LOCATION	RFETS	ECR DATE	9/7/2005
		REPLY DATE	9/7/2005

TO	Randy Thompson	COMPANY	Earth-Tech
SUBJECT	Seep # 7	LOCATION	Rocky Flats OLF
DRAWING NO.	51788-008	SPEC. NO.	

CHANGE REQUESTED

Based on the CDPHE request to remediate seep # 7due to the potential instability of berm 3 and berm 7, KH proposes to install a subsurface drain into the buttress drain rock similar to ECR #12. Drain rock will be wrapped in non woven geotextile and placed to drain the seep into the buttress drain

REPLY REQUIRED BY 9/7/2005

A DELAY IN THE PROGRESS OF THE PROJECT COULD DEVELOP IF REPLY IS NOT RECEIVED BY ABOVE DATE.

CONTRACTOR REP SIGNATURE

9-7-05
DATE

POTENTIAL IMPACT NOTICE
X SCHEDULE
X LABOR
X MATERIAL
__ NO IMPACT
__ OTHER

INFORMATION TO CONTRACTOR

RESPONSE TO CHANGE REQUEST

Based on the CDPHE and EPA directive to construct an underdrain feature to remediate Seep #7 (between berm 3 and berm 7), Earth Tech proposes a design similar to the drain constructed for Seep #3 documented in ECR-012. A T-shaped trench partially filled with drain rock wrapped in geotextile will capture the water from the seep and drain it into the buttress drain rock. A plan view of the T-trench drain is presented in the attached drawing. A cross-section detail of the trench is presented in Detail 5 on Drawing 12A (Issue 2). The only differences between this drain for Seep #7 and the drain for Seep #3 are the location and the drain material. A one-foot deep lift of washed 1.5"(-) drain rock will be used for Seep #7. Drain rock will handle the flow requirements without overly straining the geotextile.

During construction, conduct an as-built survey of A) the extent of the wet spot prior to trench excavation, B) the trench end points and intersections, C) the bottom-of-trench elevations every 10', and D) the top-of-drain-rock elevations every 10'.

RM	DM Keating	DATE	9/12/05
DM	FOR RANDY THOMPSON	DATE	9/7/05
CQAE		DATE	9/20/05
CDPHE REPRESENTATIVE	Carl Spreng	DATE	9/12/05